Subterranea

The Magazine for Subterranea Britannica

Subterranea Britannica **December 2020 Issue 55**

IN THIS ISSUE

Winsford Salt Mine
Halstead Factory Shelters
Discovering the Maginot Line
Chard Canal Tunnels

Subterranea Britannica is a society devoted to the study of man-made and man-used underground structures and the archaeology of the Cold War. The society is open to all and its membership includes all walks of life.
Members are invited to contribute to this magazine even if this just means sending very welcome snippets from newspapers and magazines.
Contributors to *Subterranea* also give their permission for articles and images to be reproduced on Sub Brit's website.

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Front cover photo: *A branch of the main gallery of the large Ouvrage du Metrich, located in the Thionville Fortified Sector a few miles south of the Bois de Cattenom. It is a huge artillery fortress, abandoned by the Army long ago. In the late 90s the Army garrison commander of Metz decided to bury all of the accesses to the ouvrages in the region. Of course that didn't keep people out. The only enemy of this fortress is a deposit of expanding gypsum slowly pushing its way up from below, causing upheaval and collapse. Still a wonderful place to visit. Photo Nick Catford*

Back page upper: *The Subterranea Britannica visit to Winsford mine in August 1997. The tour started at the visitors centre where we were given a safety induction, kitted out with our safety gear and transported into the mine in a passenger lift. The picture shows the Sub Brit party in the twenty tonne capacity lifting bucket of a Caterpillar 992. Photo Nick Catford*

Back page lower: *Boating through the Crimson Hill Tunnel on the Chard Canal. These stalactites are a short distance inside the south portal. Photo Peter Glanvill*

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Secretary: Linda Dixon
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Newsletters of Subterranea Britannica are published by the committee of Subterranea Britannica. Original articles, book reviews, press cuttings, extracts from books and journals, letters to the Editor etc are welcome. However the Editor reserves the right not to publish material without giving a reason.

The committee of Subterranea Britannica and the Editor do not necessarily agree with any views expressed and cannot always check the accuracy of any material sent in.

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Chairman's Welcome

Tim Wellburn

Tim Wellburn

Welcome to *Subterranea* 55, a splendid effort by Nick Catford, the editorial team and our contributors in delivering Sub Brit's third superb magazine of the year - notwithstanding the challenges of another national lockdown.

Our thanks also go to Tony Radstone, Richard Seabrook and the presenters who have delivered no less than a baker's dozen of "*In the Dark*" webinars on an eclectic range of subjects, providing welcome 'virtual' exploration. Our underground knowledge is greater than most external speakers' so please step up to the podium and share your enthusiasms and photographs!

Richard also masterminded a valuable new Sub Brit resource: the on-line archiving of the first 48 editions of *Subterranea* - and Linda Dixon has produced an up-to-date searchable index. Electronic copies of the more recent issues of *Subterranea* are also available to members on request to the Membership Secretary.

2020 notably saw the retirement of Martin Dixon as Chairman, after 13 years at the helm of Sub Brit. Happily, he has agreed to remain a member of the Committee, so we can continue to benefit from his vast knowledge and experience. Sub Brit was delighted to mark Martin's retirement by presenting him with a very well-earned Honorary Life Membership.

Coincidentally, the start of the year also saw Paul Sowan, Martin's predecessor as Chairman, hang up his hat after serving as a Committee member for 35 years and Chairman for around a quarter of a century - both appropriately 'geological' timescales. I suspect that we are unlikely to witness such Titans in future.

We held our first ever online AGM in October and I am grateful to the 55 members who participated, ensuring we were respectably quorate. The AGM minutes are in this issue.

And so we look forward to 2021 - albeit still with rather more hope than certainty. The Spring Meeting remains booked for 27 March at Canada Water in London's Docklands. We hope this can go ahead, and will monitor developments and confirm by February.

The (twice) rescheduled Dover "Dumpy Levels" trip is still booked for 14 March, unless English Heritage decides otherwise. Once site access is firmly restored, we will also arrange a repeat trip for those who didn't manage to get a place on the initial one.

We await 2021 dates from the Postal Museum for our two remaining 'Mail Rail' visits, and for the first of Sub Brit's extended tunnel walks.

The 'Sub Brit Europe Weekend' in Oslo, originally scheduled for May 2021, has been postponed until such time as it is feasible to undertake detailed planning and booking. However, as soon as European travel is fully restored, we intend to run a Maginot Line trip, visiting some of the restored forts, and perhaps some Belgian ones *en route*. We also have a target list of UK sites for visits - and will happily support anyone who wishes to organise a trip for members.

So keep the torch batteries charged: as soon as the world moves forward into broad, sunlit uplands, Sub Brit will be heading back underground.

chairman@subbrit.org.uk

Subterranea Britannica Annual General Meeting 2020 – Minutes

31 October 2020, Online using GoogleMeet

The meeting was opened at 10.00 by the Chairman, Tim Wellburn, who welcomed all those attending. 55 members were present. The online platform allowed members to see each other, along with a set of slides covering the content of the meeting. Attendees had the facility to add comments, by typing them in, and could then ask a question.

1. Apologies were received from:
    - Jason Holdcroft, Nic Shore, Penelope Cash and Jennie Lill
2. The Minutes of the AGM 2019 held on 27 April were published to all members in ***Subterranea* 51,** August 2019. It was proposed by Alistair Graham Kerr and seconded by Chris Hobdell that the Minutes were a true reflection of the meeting; the proposal was accepted by those attending with 6 abstentions.
3. Annual Report for the year ended 31 December 2019. This has been published to all members on Sub Brit's website. The Annual Report was also published in ***Subterranea 53***, April 2020. Tim's presentation highlighted some of the key achievements of 2019:
    - Strong financial position
    - Membership healthy (1000+)
    - 500,000+ visits to website www.subbrit.org.uk and growing social media use
    - Full programme of conferences and visits, including Berlin Study weekend
    - Major update of public and member website platforms
    - Grants for underground bodies including Williamson's Tunnels
    - International coverage in ***Subterranea*** & wide-ranging Members' Forum
4. Key Developments in 2020. Tim covered some events of this extraordinary year:
    - A year re-defined by Covid - and Sub Brit's necessary responses to it
    - 2020 Day Meetings became 2021 events - lecture & visit programmes saved
    - New ***"In the Dark"*** Webinars: going underground around the world. Tim thanked Tony Radstone and Richard Seabrook for setting these up, plus all the presenters.
    - ***Subterranea*** Magazine: wide-ranging issues delivered in April & August
    - ***Subterranea*** Archive: Issues 1-48 now online along with a new searchable Index
    - Martin Dixon retired as Chairman after 13 years of committed and inspirational leadership of Subterranea Britannica. Tim announced that Martin had been awarded Honorary Life Membership, in recognition of his substantial contribution to Sub Brit over the years.
5. Statement of Financial Activities: Sub Brit's Accounts have been signed off by the Committee and Independent Examiner and have been filed at Companies House and the Charity Commission.
    - David Ferris asked about Sub Brit's closing cash balance. Tony Radstone replied that Sub Brit was using this to make grants to support underground activities. Martin Dixon replied that SB's cash reserves are in line with our policy to keep between 6 and 18 months of turnover in our Reserves.
    - David Ferris also queried a substantial Income for events. Tony Radstone pointed out that this was matched by expenditure for each event.
6. Elections of Officers and Committee. Tim explained recent changes:

    Retired:
    - Paul Sowan (Trustee). Paul served on the Committee for over 35 years, of which 25 years was spent as Chairman.
    - Alistair Graham-Kerr (Committee Member)
    - both were thanked for their contributions.

    Joined:
    - Neil Iosson (previously co-opted)

    Changed Roles:
    - Martin Dixon: Retired as Chairman; continues as Committee Member
    - Tim Wellburn: Acting Chairman (from June 2020)
    - Richard West: Acting Vice-Chairman (from October 2020)

    The motion that nominations for Sub Brit's Committee be considered '*en-bloc'* was proposed by Phil Catling and seconded by Bob Templeman. The motion was carried unanimously.

7. The motion to elect the following Committee members was carried unanimously. There are still vacancies for more members to join the Committee – please get in touch if you'd like to discuss or come along to a meeting to see how it works.

The elected Committee for 2020/21 is:-

Tim Wellburn	Chairman
Linda Dixon	Secretary
Tony Radstone	Treasurer
Richard West	Vice Chairman and Membership Secretary
Richard Seabrook	Member (Webmaster)
Phil Catling	Member (SB Meetings)
Jason Hughes	Member (Shop mailings)
Neil Iosson	Member (Website content manager)
Martin Dixon	Member
Bob Templeman	Member
Chris Gray	Member

The Meeting officially closed at 10.25.

Post AGM Note: Due to the extended reporting period, we forgot to record that Nick Catford resigned from the Committee in September 2019. Nick was also awarded Honorary Membership in recognition of his enormous services to Sub Brit, as a committee member for over 30 years and lately as membership secretary. Nick continues as Subterranea *editor.*

Spring Meeting 2021

Saturday 27 March, commencing at 10.20am

Canada Water Theatre (new venue**), in association with the AGM

Covid permitting, we hope to run the Spring Meeting in March at a new venue for us.
The Meeting will follow Sub Brit's Annual General Meeting (see panel page 4)

There are four diverse speakers for us:

* Robert Stephenson, tour leader at Brompton and Kensal Green Cemeteries on 'The horror of premature burial'

* Wesley Perriman – the Nuclear Curator, on the remaining bunkers and shelters at Christmas Island and the Maralinga nuclear test site

* Emily Glass will share her doctoral research on the Mushroom shaped bunkers of Albania

* Professor Neil Hyatt FRSC NDA Chair of radioactive waste management on the geology and construction of Deep Repositories for Nuclear waste

The programme and speakers will be confirmed on the website and as always we are very pleased to welcome short talks or updates from Members – presentation facilities will be available. Short talks can be on any underground space, and can last between 5 minutes and 15 minutes, so send in your suggestions.

Contact Phil Catling on pcatling@subbrit.org.uk

Cost £22 to include refreshments, or £25 on the day.
Booking will open in the New Year
Non members are very welcome to attend.

*** Please note new venue ***

Canada Water Theatre (within Canada Water Library building),
21 Surrey Quays Road, Rotherhithe, London SE16 7AR.
Two minutes walk from Canada Water tube station
on the Jubilee Line (4 stops from Waterloo) and on London Overground.

Subterranea Britannica

Notice of Annual General Meeting 2021

The AGM will be held on Saturday 27 March 2021*, commencing at 10.00am

at Canada Water Theatre (new venue**)
in association with the Spring Meeting

Attendance is open to all current members of Subterranea Britannica

* Note: Every effort will be made to hold the meeting on this date; however, due to Covid-19 restrictions which may be in place at the time, it may be necessary to change the arrangements
This will be advised by email to all members

Documents for the AGM will be available on our website at www.subbrit.org.uk
at least 28 days in advance of the meeting. An email will be sent to advise this

Documents will be sent to those members who have registered to receive them by post

Minutes of the AGM 2020 are printed elsewhere in this magazine

**** Please note new venue ****

Canada Water Theatre (within Canada Water Library building)
21 Surrey Quays Road, Rotherhithe, London SE16 7AR

Two minutes walk from Canada Water tube station
on the Jubilee Line (4 stops from Waterloo) and on London Overground

SUBTERRANEA BRITANNICA DIARY

Summary of Forthcoming Events

Sub Brit specific events

2021

16 January Committee Meeting – Online

1 March Copy deadline for *Subterranea* 56

14 March Visit to Dumpy Level, Dover - Trip 1

27 March Spring Meeting & AG, Canada Water London - See Notice in this *Subterranea*

30 April *Subterranea* 56 published

19 June Committee Meeting, Canada Water Library

1 July Copy deadline for *Subterranea* 57

31 August *Subterranea* 57 published

16 - 17 October Site Visits, Northamptonshire

1 November Copy deadline for *Subterranea* 58

Mid-December *Subterranea* 58 published

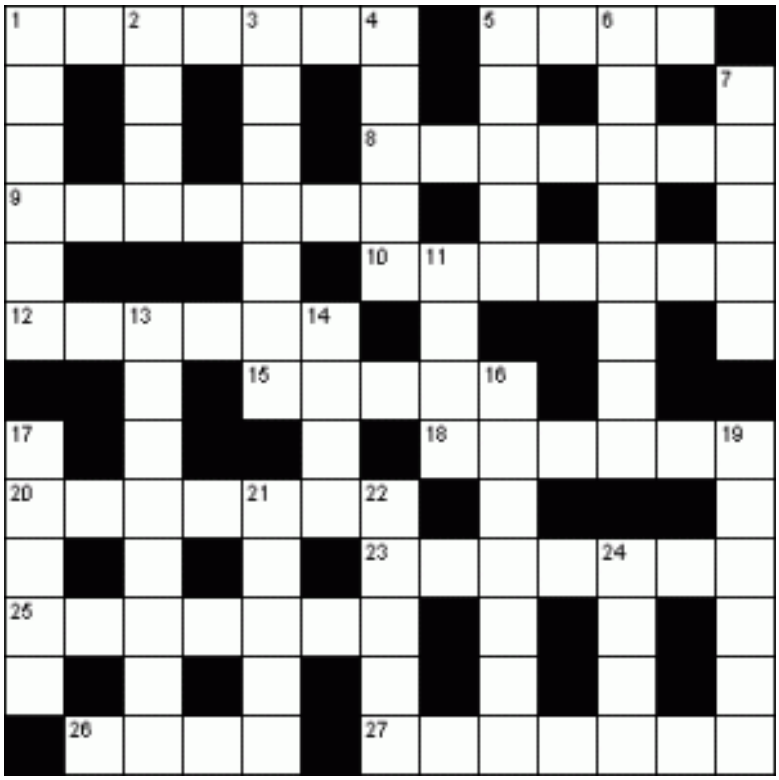
For web links to these events please visit *www.subbrit.org.uk/events*
or contact the organisation concerned

If you know of other relevant events run by other societies, please let us know so that they can be advertised in the next edition and on the website

Sub Brit Crossword

Martin Dixon

Faced with another day in 'lockdown', I decided to have a crack at compiling a crossword for Sub Brit. (Most of) the clues have an underground element and the clues are general knowledge rather than too cryptic. As is fitting for Sub Brit, there are more 'down' clues than across!



ACROSS

1. Piccadilly Line station that opened as Enfield West (7)
5 Mined at Dolaucothi in Wales (4)
8 John Osborne looked back like this (2,5)
9 Military messages might be carried in one (7)
10 Southern Africa country known for its diamond mining (7)
12 European city whose metro stations include Syntagma and Piraeus (6)
15 County where Hope Cove Rotor station was located (5)
18 A nice piece of 5 across (6)
20 24 Leinster Gardens? (7)
23 Tutankhamun was the oldest known sufferer from this disease (7)
25 Useful in a Pit Head Baths? (7)
26 ..with my little eye, something beginning with 'A' (1-3)
27 These stones were quarried for Stonehenge (7)

DOWN

1 Ukrainian city with extensive underground catacombs that originated as limestone mines (6)
2 Fan Bay shelter is in this county (4)
3 Expert with ancient fingers? (3, 4)
4 Useful (though boring) in mining (5)
5 Reigate 'caves' produced the raw material for this (5)
6 Important for all underground explorers (8)
7 Gas used in incandescent light bulbs (5)
11 Guy Burgess went to school here (4)
13 Difficult underground headgear? (4, 4)
14 Simulated Environment Test Signal (4)
16 Blue Danube was Britain's first weapon of this sort (7)
17 Limestone landscape that includes solution caves and sinkholes (5)
19 River above the world's first underwater tunnel (6)
21 Vessels that make most noise? (5)
22 Caused by coal fires in Victorian London (5)
24 A vertical mineral vein (4)

Answers are on page 51

NEWS

Miscellany compiled by Nick Catford

NEWS – ARCHAEOLOGY

New Lidl store with views of Viking history below

A new Lidl store built above 11th-century Viking ruins in Dublin has used glass floors to allow shoppers to look at the structure below.

The Lidl store on Aungier Street opened on October 15 and managers have made an effort to showcase the significant archaeological finds on the site. It lies in what is thought to have been a Hiberno-Norse suburb of Dublin. The store features a glass window in the floor allowing customers to see the preserved domestic structure below, as well as information displays about the site.

Built around 1070 AD, the structure was found during the excavations at the Scape development and provides a remarkable insight into how people once lived. It was built by digging a pit in the ground and lining it with blocks of local calp limestone, before laying a floor of planks and building an overarching structure of post and wattle, roofed with thatch.

For about one hundred years, different generations used the sunken-floored structure in multiple ways and it burned to the ground at least once. Undeterred, its inhabitants rebuilt, raising the floor level with clay, realigned the entrance passage, constructed a new doorway and installed a stone-lined cistern fed with water from outside by a gully. The building is unlikely to have been a home given its small size but was probably a space used for storage or craft activities.

It survived because it was sunken, unlike the surrounding community of houses, outbuildings and plots that have now disappeared.

SOURCE: *MailOnline,* 23 October 2020.

Prehistoric mastodon discovered by gold miners in Colombia

Fossils of a mastodon, a giant prehistoric ancestor of the modern-day elephant, have been discovered in a gold mine in central Colombia. Miners working in a tunnel near the town of Quinchia, in the central-west province of Risaralda, discovered the remains including an intact tusk measuring more than three feet long.

A complete mammoth tusk measuring 3.5 feet long was among the fossils found by the miners

While mastodon fossils have been found in other parts of Colombia, these are the first found in Risaralda and could mean more discoveries are awaiting nearby. These animals lived in herds; they didn't live alone, a little like the herds of elephants we see in Africa today.

Mastodons have traditionally been thought to have gone extinct because of overhunting by early humans, but more recent analysis suggests they may have succumbed to rapid climate change.

SOURCE: *MailOnline*, 24 September 2020.

Archaeologists uncover cache of unopened sarcophagi in Egypt

Egypt has unearthed a trove of ancient coffins in the vast Saqqara necropolis south of Cairo, announcing the discovery of more than 80 sarcophagi. The Tourism and Antiquities Ministry said in a statement that archaeologists had found the collection of colourful, sealed caskets which were buried more than 2,500 years ago.

Egypt has sought to publicise its archaeological finds in an effort to revive its key tourism sector, which was badly hit by the turmoil that followed the 2011 uprising. The sector was also dealt a further blow this year by the coronavirus pandemic.

In early October Egypt revealed 59 sealed sarcophagi, with mummies inside most of them, in the same area of Saqqara. The Saqqara site is located south of Cairo and the vast burial complex, which also features the step pyramid of Djoser, served the ancient capital of Memphis. It also includes the famed Giza Pyramids, as well as smaller pyramids at Abu Sir, Dahshur and Abu Ruwaysh. The ruins of Memphis were designated a UNESCO World Heritage site in 1970.

The plateau hosts at least 11 pyramids, including the Step Pyramid, along with hundreds of tombs of ancient officials and other sites that range from the 1st Dynasty (2920-2770 B.C.) to the Coptic period (395-642).

The majority of the coffins found at Saqqara so far have contained mummified remains of priests, top officials and elites

One of dozens of ornately decorated sarcophagi was opened for the first time before assembled media. The team slowly revealed mummified remains wrapped in burial cloth that bore hieroglyphic inscriptions in bright colours. The majority of coffins housed mummified remains which initial research suggests would have been priests, top officials and elites in ancient Egyptian society.

All of whom would have likely been subject to ancient Egypt's complex burial rituals after they died, including having their brains removed with an iron hook. The coffins would be transported to the Grand Egyptian Museum to be displayed to the public.

SOURCE: *MailOnline*, 20 October 2020.

NEWS – CONSERVATION AND HERITAGE

Restoration of Crystal Palace subway starts

After years of fundraising work, condition survey work to support the restoration of the astonishing Crystal Palace subway has now started following the award of a contract to the heritage conservation architects Thomas Ford and Partners.

Photo Nick Catford

The full restoration is expected to cost around £3.1 million, and the Mayor of London's Strategic Investment Pot has already committed £2.3 million towards the works. Bromley Council, which owns the site, expects to receive £500,000 from Historic England and is applying for £296,000 from TfL, as the subway runs under the main road, with £5,000 coming from the Friends of Crystal Palace Subway.

It is hoped the project will eventually remove the structure from Historic England's Heritage at Risk Register.

The works are part of a two-year project that will see some lost parts of the site restored and the fabric made good. The long term, if currently unfunded aim, is to reopen the subway on a permanent basis. The restoration will also allow the council to start looking for a commercial partner for the site, who would fund the cost of visitor facilities at ground level linked through to the Subway.

Although the subway has been occasionally open for tours, while the restoration works are underway, the Friends of Crystal Palace Subway say that they won't be able to open the site to the public. The restoration is currently programmed for completion and reopening to the public in late summer 2022.

SOURCE: *Ian Visits* website, 3 August 2020.

See also *Subterranea* 36 (August 2014), page 17

Lump coal crisis

It is currently proposed that no more coal in lumps is to be mined in Britain; it will be banned. This could have serious implications for the heritage sector. Coal will still be produced for power stations but this is small coal because when it arrives at a power station it is ground in ball mills into really fine powder.

Forester's Folly, one of the surviving free mines in the Forest of Dean

The Free Miners of the Forest of Dean are exempt from the proposed ban. Small quantities of steam coal should still be available for some time from South Wales and a small mine in the North of England can supply anthracite, but not in large enough quantities for a mainline steam locomotive.

An option is to import Russian coal for locomotives such as Flying Scotsman and Tornado but this will involve a larger carbon footprint compared with opencast mining in the North of England. It is not only railway engines that require lump coal, there are other locomotive-type boilers to be fired. What about traction engines and steam-powered road vehicles?

The steel industry requires coking coal for blast furnaces and blacksmiths use coke breeze. For traditional demonstrations of blacksmithing, coal in small lumps is often in use. Country houses and stately homes like to have a traditional coal fire over the Christmas period and ordinary domestic coal fires are to be completely prohibited. The latter prohibition will hardly be of concern in London where traditional coal fires came to an end when smokeless zones were introduced following the Clean Air Act of 1956.

SOURCE: GLIAS *Newsletter*, November 2020.

Shell Grotto in Margate to receive government grant

Major tourist attractions in Kent are among hundreds to benefit from a £1.57 billion cash boost from the government to support them through the coronavirus pandemic. Romney, Hythe and Dymchurch Railway, the Kent and East Sussex Railway in Tenterden, the Shell Grotto in Margate and Tunbridge Wells' Spa Valley Railway are among those to receive a financial injection from the Culture Recovery Fund for Heritage as part of a lifeline package for organisations hit by the crisis.

The Grade I listed Shell Grotto is hailed as "one of Margate's great little gems". Discovered by the Newlove family in 1835, almost all the walls and roof are covered in mosaics created entirely of seashells, totalling about 2,000 square feet of mosaic, or 4.6 million shells.

£48,200 of funding will greatly help with the Grotto's conservation efforts. In 2016 Sub Brit sponsored the restoration of one of the roundels with a grant.

SOURCE: *KentOnline,* 9 October 2020

See also *Subterranea* 41 (April 2016), page 78

Revamped nuclear bunker wins Museum of the Year award

With 2ft-thick concrete walls and bombproof doors, the former Anti-Aircraft Operations Room in northwest Scotland was meant to be a place for tracking Soviet aircraft at the height of the Cold War. Fortunately, the planes never turned up and the bunker has instead become the unlikely home for a museum telling the story of Gairloch, a coastal village 75 miles from the nearest town.

Gairloch Museum – the creation of which has involved determined people power, intense local pride and impressive vision – has been rewarded in the world's biggest museum prize. It was recently named as one of five organisations to share the title of UK Museum of the Year, winning for an eight-year campaign to turn a village eyesore into something rather beautiful.

The site was previously used as a council roads maintenance depot. Museum trustees persuaded the council to sell it to them for £1 and embarked on a £2.4m fundraising campaign to convert it. About ten percent of the money has come from local people in what probably felt like endless raffles and pub quizzes.

Gairloch is an isolated community: the nearest town, Inverness, is about 75 miles away and its high school has the widest catchment area in Europe. Creating the museum involved the removal of interior walls and the creation of windows through 2ft-thick walls; the blast doors have been kept. It opened in July 2019 and visitor numbers doubled to 12,000 in the first six months.

The museum's collection includes examples of the area's unique geology, including the oldest rocks in Western Europe, as well as many textiles, tools and furniture that shine light on the area's social history. There is also a strong Gaelic archive, one of the star exhibits of which is the Rubh Re lighthouse lens, one of the largest and last of its kind.

Judges for the Museum of the Year prize said they had been captivated by Gairloch's story of people power and local pride, which had "created a buzzing new community hub, and produced a sustainable cultural landmark for generations of visitors to enjoy."

SOURCE:*The Guardian,* 12 October 2020

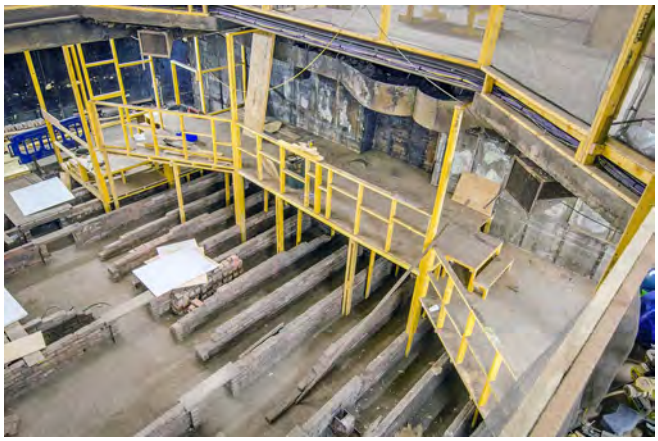
Barnton Quarry ready to open to public after nine-year refurbishment

Barnton Quarry RGHQ in Edinburgh has recently undergone a significant refurbishment programme and is preparing to open to the public after a dedicated team of volunteers spent the last nine years renovating the facility. Owner, Scotscrown Ltd, has worked with the volunteers to transform the 30,000 sq. ft. site, which was ravaged by fire in 1993, more than ten years after it was decommissioned.

Plans to open this summer were delayed due to Covid-19, and its owners have laid the groundwork for hosting virtual tours in the coming months thanks to a new full fibre broadband connection. Powered by CityFibre, the

site now boasts state-of-the-art full fibre connectivity.

The connection, installed by strategic partner 2 Circles, will allow Barnton Quarry to not only host virtual tours to a global audience, but it will also be available to local schools through virtual learning tools and augmented reality, all while underpinning a new security and CCTV system.



Work underway to rebuild the original ops floor viewing gallery which has been built from the 1951 plans

The proprietor of the site is aiming to welcome 100,000 guests when it officially opens next year. He is also a part-owner of Scotland's Secret Bunker at Anstruther which has seen its tourist experience transformed due to a full fibre connection. He says digital connectivity is key to them realising their ambitions in Clermiston.

Barnton Quarry is a site of national importance and its owners have huge plans to make it an attraction for locals and visitors that all of Edinburgh can be proud of. While it may initially seem strange for a Cold War bunker to need a cutting-edge full fibre connection, the reality is that fast, reliable internet is so important for businesses, particularly visitor attractions looking to capture the imaginations of a global audience.

SOURCE: *Edinburgh Evening News,* 16 September 2020

NEWS – HEALTH & SAFETY

Three miners are rescued from a Colombian coal mine

Three miners have been rescued after spending four days trapped underground in a Colombian coal mine. They had been trapped 88 feet below the surface after their mine cart derailed and caused a tunnel to collapse. The group tried to walk their way to the El Alisal mine exit but found their path was blocked.

The workers, who were all on the job for less than a week, at one point huddled as a group and thought they would never again see their families.

SOURCE: *MailOnline,* 24 August 2020

NEWS – MILITARY AND DEFENCE

'Throwbots' give Marines the drop on the enemy

A reconnaissance robot that rights itself after being deployed is one of several gadgets being tested on the Rock of Gibraltar.

Royal Marines have deployed 'throwbots' that allow them to see round corners or into caves during a training exercise in the tunnels on Gibraltar. Marines of the Fleet Protection Group have been experimenting with new kit and technology to further develop the Future Commando Force.

Troops of 43 Commando, whose primary role is the protection of Britain's nuclear deterrent submarines based in Faslane, Scotland, have been experimenting with remote-controlled ground-based drones capable of being thrown over walls or into caves.

The so-called 'throwbots' will self-right in almost all scenarios, no matter how they have landed. They can be dropped almost 32ft, and thrown four times as far, without damage. A stabilised camera located between two wheels provides live imagery to troops, kept safe behind cover.

The real-time video images support assaulting forces without the need for soldiers to expose themselves to greater danger. They will most likely be used as troops fight in new locations they have not been able to observe. The robot has electronic circuitry that self-calibrates after landing. After two seconds, the gyroscopes stabilise and the throwbot can be deployed on its mission.

A member of the Royal Marines 43 Commando group lobs a tethered throwbot

In open ground the robot can be operated up to 450ft away from the controller; this reduces to about 148ft indoors or in cave complexes. It can also be submerged for up to 30 minutes in 3ft of water.

The Royal Marines are using Exercise Serpent Rock in Gibraltar to help design the Future Commando Force and

adapt to future threats. It is hoped that trialling cheaper "off the shelf" technology will help get better value out of the Royal Navy's annual £6.3billion budget.

SOURCE: *Daily Telegraph*, 17 November 2020

Norway reopens submarine base to help Americans

A secret Cold War-era nuclear submarine base in Norway is to be reopened as America and Russia wrestle for control of the Arctic Ocean.

Olavsvern, which was closed in 2002, is a colossal complex carved into a mountain near the northern city of Tromso. It includes 9,800ft of deep-water underground docks that can house and refit nuclear submarines. The base will be open to the US Navy's three Seawolf submarines.

Russia has built up its northern fleet and NATO has become wary of Russian submarine activity in the Barents Sea and the North Atlantic. In early September the Norwegian Ministry of Defence approved an agreement that will allow the country's armed forces and US military, as NATO allies, to use the base, which is 220 miles from the Russian border. It was shut during a thaw in relations with Russia and in 2015 was leased to seismic research vessels for Gazprom and other state companies.

In February Moscow accused Oslo of continuing to "escalate tension and increase the risk of military action" by allowing American nuclear submarines to use Norwegian ports.

The US Navy has been using an open harbour at Malangen, south of Tromso, to resupply their Seawolfs. Modifications to the Tromso naval base, which has 270,000sq ft of housing and dockyards sheltered under 900ft of hard rock, include a secure berthing area for USS *Jimmy Carter*, the largest nuclear attack submarine.

SOURCE: *The Times,* 12 October 2020

House with an ROC post in the garden up for sale in Wales

The property near Llanfyllin includes seven and a half acres of land. The bunker is located on a mound in a small wooded rectangular compound near to the house. The Llanfyllin ROC post had a short life, opening in 1965 and closing in 1969.

SOURCE: *Shropshire Star*, 2 October 2020

Napoleonic-era battery at Dungeness sold

26 acres of Freehold land incorporating the remains of a Napoleonic-era battery at Dungeness have been sold. The land is sandwiched between Battery Road/Dungeness Road (southern side) and Kerton Road (northern side) at Lydd-on-Sea, with the eastern boundary abutting the Romney, Hythe and Dymchurch railway line.

During the Napoleonic Wars it was this area known as Romney Marsh which was considered a likely landing ground for Napoleon's army. A military canal was built from west to east along the base of the line of hills that mark the Saxon shoreline. Martello towers (circular forts with a gun on a swivel on top) were built along the coast together with redoubts and batteries.

Part of the site incorporates the remains of No 1 Battery, which is believed to have been built in 1798 and modified in 1860. The battery itself was a self-contained triangular fort, originally built as part of four forts and a Redoubt on the Dungeness peninsula as part of the coastal defences against the Napoleonic invasion threats. There would have been an underground element to the battery but nothing is visible now.

The site was reoccupied in World War II although today only some remains of the fortification and gun emplacements exist. The land was sold for £60,000.

SOURCE: Clive Emson, Land and Property Auctioneers

Taiwan to list 117,000 air-raid shelters in case of Chinese attack

Chinese warplanes intrude into Taiwan's air defence identification zone (ADIZ) with increasing frequency; the government has pledged to post online the locations of over 117,000 air-raid shelters in the event of an attack by the People's Liberation Army (PLA).

As China continues to increase its aggressive military actions around Taiwan, including incessant intrusions by People's Liberation Army Air Force (PLAAF) warplanes, Taiwan People's Party (TPP) legislator Kao Hung-an submitted a written request to the Cabinet to provide the list of government procedures in the event of changes in the military situation. In response, the Cabinet stated that in addition to strengthening the preparedness of the nation's military, the government will also raise people's basic understanding of emergency evacuation and rescue protocols.

Kao wrote that the government should make preparations in advance before the PLAAF takes more aggressive actions. In addition to strengthening Taiwan's defences, he suggested raising public awareness about dealing with a national emergency.

Air-raid shelter surviving from Japanese colonial era

Kao noted that most Taiwanese have never encountered war and lack basic knowledge about emergency evacuations and rescue procedures. He then called on the government to better inform the public on what to do during an attack, including where the nearest air-raid shelters are located and where to seek treatment if injured.

The legislator pointed out that Sweden, Switzerland and Israel have already issued civil defence manuals to its citizens. Kao suggested that in addition to shelters, the government should also remind the public to prepare sufficient food and water and how to recognize disinformation.

SOURCE: *Taiwan News,* 4 November 2020

Royal Marines take on underground mission at Burlington

Royal Marines held at high-readiness for maritime security operations have pushed themselves in a vast underground complex at Spring Quarry, Corsham ahead of being deployed to the Mediterranean. Marines from Juliet Company of Plymouth-based 42 Commando work in small teams on Royal Navy warships around the world, ready to react to emergencies and specialist missions, like counter-piracy and boarding operations.

J Company is also the home of the Fleet Contingency Troop (FCT) – experts in a range of security missions and the UK's only force trained in opposed boarding operations (known as Level 3 (Opposed)) outside of Special Forces.

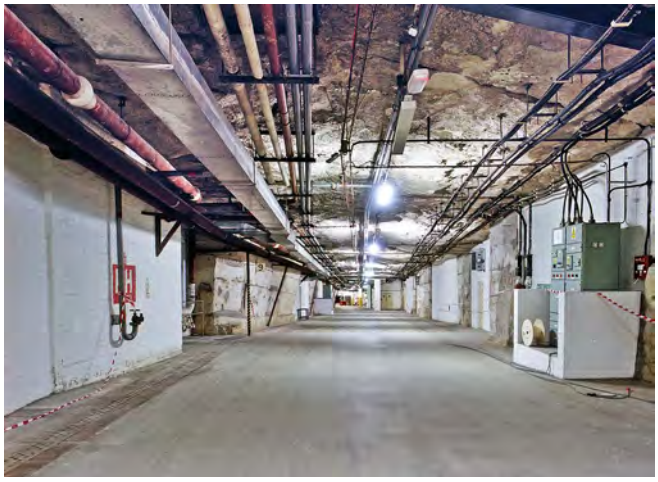


Photo Nick Catford

The FCT have been training in the Corsham Tunnels, below the town of Corsham, near Bath. The complex of tunnels became a facility for the potential relocation of the government in times of crisis during the 1950s with the threat of nuclear war looming large.

These days, parts of the complex are a useful training area – a place where the commandos can push themselves in the art of close-quarters combat, testing their well-rehearsed tactics, techniques and procedures to quickly assess and deal with threats in even the trickiest of environments.

SOURCE: Royalnavy.mod.uk website, 7 October 2020

Stoke Holy Cross Chain Home buried reserve surveyed

In 2019, Cotswold Archaeology was commissioned to record part of a reasonably well-preserved 'Chain Home' early warning radar station, located just south of Norwich.

Chain Home was a pioneering network of radar stations constructed prior to, and during, the Second World War. An experiment in 1935 proved conclusively that it was possible to detect aircraft by radio.

The experiment worked by 'illuminating' the sky with radio waves whereby sufficient energy would be reflected from an aircraft to permit detection on the ground via a receiver. After further research, funding was provided for the construction of a 'chain' of early warning stations along the east coast of Britain using the new radar technology. These stations became the first radar to be organised into a complete air defence system used in wartime operations.

A key component of each station was a pair of 'buried reserves', which comprised underground bunkers and associated surface features containing a set of duplicated backup equipment, intended for use if the principal transmitting or receiving sites were attacked and put out of action.

Ventilation shaft. Photo Matt Herring

Cotswold's task was to record the visible, above ground remains of the 'transmitting' buried reserve at Stoke Holy Cross Radar Station, which required the identification of many nondescript concrete features scattered amongst the encroaching vegetation. Luckily, Chain Home stations all follow a fairly standard form and further research allowed the identification of most of these features.

These included ventilation shafts, a holdfort for a Bofors anti-aircraft gun, concrete plinths for the steel transmitting tower, and heavy concrete access hatches for the underground reserve itself, including their steel rollers and rails. Although the underground reserve is presently unsafe to enter, the positions of the above ground features were such that the layout of the reserve could be reliably determined by comparing the site with other, better preserved examples at stations around the country.

SOURCE: *Cotswold Archaeology*, 15 October 2020

Police blow doors of WWII bunker in Banstead, Surrey

Police have descended on a Surrey farm, following reports from neighbours of an explosion in the early hours of Saturday 26 September. The activity at Courtlands Farm in Banstead is thought to be related to the ongoing investigation into the death of Sergeant Matt Ratana at Croydon Custody Centre in south London in the early hours of Friday 25 September.

Aerial view of some of the magazines

Officers are thought to have used explosives to blow off the door of a property at Courtlands Farm. It is believed that the door was part of the WWII Equipment Ammunition Depot Magazine No. 116.

The site at Banstead was one of the thirty-four EAMs constructed between 1938 and 1939 to store and supply ammunition for anti-aircraft batteries surrounding and defending London.

SOURCE: Various, September 2020

NEWS – MISCELLANEOUS

New underground repository for spent nuclear fuel in Sweden

On 13 October, the Municipality Council of Östhammar in Sweden voted in favour of a formal acceptance of the final underground repository for spent nuclear fuel. The community has shown strong support for the facility throughout the development process. Earlier this year, 82 percent of the community respondents to the annual poll in Östhammar Municipality stated that they were in favour of SKB's plans to build the final repository in Forsmark.

The final decision is now with the Swedish Government and is the last remaining decision point for SKB to obtain the construction licence for their repository. It is internationally recognised that a permanent deep disposal facility is the safest and most secure way to manage higher-activity waste for the long term. Countries around the world are planning to dispose of their higher-activity waste in this way. As well as Sweden, Canada, Finland, France, and Switzerland are well ahead of the UK in their implementation.

In the UK, RWM plan to work in partnership with a number of communities from across the country to explore how having a GDF in their area can provide long-term economic and employment benefits and play a major part in their development plans. The search for a host community is a nationwide process, based on consent, and includes detailed investigations to make sure there is a suitable site at which to construct a safe and secure GDF.

SOURCE: *Radioactive Waste Management*, 16 October 2020

Family of undertakers build modern barrow tomb to house ashes of 990 people

A family of undertakers have branched out and built a modern take on a prehistoric tomb to meet the demand for an alternative to burial. The Round Barrow in Corscombe,

Dorset, is only the fifth tomb of its kind in the country and has recently opened.

The project, which has 990 niches to hold urns containing the ashes of loved ones, was created by the Vassie family. They invested a six-figure sum and five years into creating the traditional Neolithic-style burial mound.

The ancient mounds built over the dead, known as long or round barrows, had not been used since about 2,000 BC, but they have seen a rise in popularity since farmer Tim Daw created the first one on British soil in 5,500 years in 2014.

The Round Barrow was built entirely from 900 tonnes of Purbeck stone and has 11 passageways and chambers around a central chamber. Most of its 990 niches hold two or three urns, with 105 larger family ones that can hold either six or nine urns, which are made by two Dorset potters. On the outside the structure is covered in earth and in time will have wild flowers growing all over it so only the entrance will be visible.

SOURCE: *MailOnline,* 7 October 2020

Australian cave school recognised for its important historic role

Former students of one of Australia's most unusual schools, taught from the inside of a limestone cave in the central Kimberley, have returned to recognise the important role it played in history.

The two caves allowed for two separate classrooms at the school

The Gogo Cave School, in the remote Aboriginal community of Bayulu outside Fitzroy Crossing, was the first school in Western Australia to be established on a remote pastoral station that allowed children to attend school on country rather than being sent to a town or mission.

It was considered a pilot at the time, pioneered by Cyril Burcham, a young teacher three years out of college who had been working at the Fitzroy Crossing mission school. The two caves, originally carved out to be used as an air-raid shelter during World War II, were about four metres wide and only just tall enough for an adult to stand up in some parts. They served as two classrooms between 1957 and 1962.

Even today, holes remain on the walls of the cave where blackboards and shelves were hammered in. The cave school's significance to the Bayulu community and the broader role it played in remote education was marked in October with the unveiling of a plaque, written in the three languages of English, Gooniyandi and Walmajarri.

SOURCE: *ABC News,* 24 October 2020

An explosive find in the Manawatū Gorge in New Zealand forces rerouting of new road

Waka Kotahi New Zealand Transport Agency is getting ready to build a new road between Ashhurst and Woodville, across the Ruahine Range, to replace State Highway 3 through the gorge. The gorge highway was closed in April 2017 after landslips, and amid fears a hillside would fall on to the road.

While the agency is waiting on the result of an Environment Court hearing to get resource consents to build the new highway it is preparing to do other work. Part of that includes building a site on the east side of the gorge where contractors will work from when building a bridge across the Manawatū River.

But part of that site may have to shift, after the discovery of two concrete bunkers in the area. Despite their almost inaccessible location and overgrown state, graffiti inside them indicated they were not a total mystery.

There was evidence of an old path to the bunkers, which were set into the hillside; they both had thick concrete doors overgrown with foliage. The thick walls and mesh ventilation grills on the doors indicated the bunkers were

used for the safe storage of explosives. The smaller of the two was probably used to store smaller items such as detonators. The materials used indicate the bunkers were built pre-1900.

Given that the gorge road was completed in 1872, with more improvements made over time, the bunkers were likely built to store explosives used while building the road on the western side of the gorge. The location of the bunkers was an opportunistic use of the stable cliff far away from the gorge road. There had been some modification of steel parts of the bunkers, suggesting they were used into the 20th century.

The bunkers were entered into a national archaeological site database and it was recommended any new access tracks were built well away from them.

SOURCE: *Stuff,* 6 November 2020

Thieves tunnel into Nottingham wine cellar

In one of the more unusual crime capers of recent times, an enterprising crew of thieves with impeccable taste in fine wines tunnelled into a secure high-end cellar in Nottingham, and stole as much as £50,000 worth of classic vintages, port, and whiskey.

The thieves were caught when a female member of the staff went down to the cellar to replace a high-value bottle that had been stolen in the store, only to find the thieves swigging vintage Champagne as they rifled through some of the best wines in the world. They tried to pass themselves off as officials from the local council carrying out an inspection.

Among the missing items are believed to be bottles of Champagne once owned by the father of Jeffrey Epstein pal Ghislaine Maxwell, the publishing tycoon Robert Maxwell. The mogul had reportedly ordered in the bubbly to see in the millennium, but, after it went un-drunk, sold it off to a collector.

The gang created a route through derelict buildings surrounding the city centre merchants then dug a tunnel through the wall of a neighbouring property.

Vintage Wines Ltd. are embarrassed by the theft and had to contact celebrities and ordinary people who use the company's storage vault for their high-price bottles. Many of the clients "were distraught."

A collection of fine wines that once belonged to the singer Whitney Houston, who died in 2012, was being held in storage in the cellars but was not among the stash stolen by the criminals. Houston, who struggled with alcohol addiction, is believed to have given the bottles to an employee.

The suspects are believed to have struck twice, on Oct. 17 and then again on Oct. 23. They carried out their caper during the shop's normal opening hours to avoid triggering alarms but were said to be caught red-handed by a member of the staff.

They are thought to have dug into the cellar via derelict buildings surrounding the business creating a rat-run into the store's vaults. Two men have been charged with criminal damage and burglary.

SOURCE: *Daily Beast,* 4 November 2020

Chelsea house collapses during construction of mega-basement

A pair of four-storey town houses worth millions of pounds have collapsed in west London. A 25m cordon was put in place and about 40 people had to leave nearby properties in Durham Place, Chelsea, while drone teams and police dogs searched the rubble.

Emergency crews were called at 23:35 GMT on Monday 2 November after the buildings, which were being redeveloped with a new mega-basement, fell in. No injuries have been reported.

The collapsed buildings form part of a terrace that was built in the late 1700s, opposite land owned by the Royal Hospital Chelsea. A seven-bedroom house in the block sold for £16m last year. According to neighbours, renovations were being carried out at the block, including an enlargement of the existing basement.

Kensington and Chelsea Council had approved an extension to be built on the lower ground floor of the buildings in 2018. The reason for the collapse is being investigated by the Health and Safety Executive.

SOURCE: *BBC News,* 3 November 2020

NEWS – MINES AND MINING

World's largest diamond mine to close

The price of pink diamonds is expected to soar after the Argyle Diamond Mine which produced nearly the entire world supply closed at the beginning of November.

The world's largest pink diamond mine began when a group of geologists stumbled across a stone in the Kimberley region of Western Australia in the 1970s. Since owner Rio Tinto began production in 1983 the mine has produced 95 percent of the world supply of the rare diamonds. Some diamond colours are caused by trace elements such as nitrogen (yellow) or boron (blue), but pink diamonds have not been found to have trace elements.

Instead, scientists believe the pink hue comes from a distortion in the crystal lattice caused by intense heat and pressure. The pink stones have accounted for less than 0.01 percent of Argyle's total output, with the mine producing more than 865 million carats of rough diamonds over its life. In 2019, Argyle employed 373 people and produced 12.9 million carats of gems.

Most of the diamonds mined at Argyle are browns of which only five percent are gem quality; however the mine has consistently produced high-quality pink diamonds making it a unique deposit. But Rio Tinto has decided to close the mine as the supply of pinks is running out and it is now too deep to excavate beneath and extract them.

The drilling costs are growing, and profits deriving from the diamonds produced are not enough to cover all costs. The company only had enough reserves to mine to the end of the year.

The closure of Argyle will take 75 percent of Rio TInto's diamond output down, but the impact on the mining giant's earnings will be less than two percent as diamonds are a small part of their overall business. Rio Tinto estimates it will take five years to decommission the mine and to start rehabilitation works, followed by restoration and monitoring.

Kimberley Fine Diamonds proprietor Frauke Bolten-Boshammer, based in Kununurra, 200km north of the mine, told Bloomberg in July that pink diamond prices had quadrupled in the last 10 years already.

The last Argyle pink diamonds were sold to specialists round the world in November in a trade sale known as a 'rough tender'. The 'Specials' tender sold off diamonds larger than 10.8 carats.

SOURCE: *MailOnline,* 1 November 2020

Scotland's first gold mine opens

The Cononish gold mine, near Tyndrum in the Loch Lomond and the Trossachs National Park, is due to start production before the end of November. The company behind the project, Scotgold Resources, is aiming to produce 23,500 troy ounces of gold on average per year and believes it can recover more than 176,000 ounces in total – worth £255million at current prices.

Around 25 percent of the gold will come out in a form suitable to sell directly on to jewellers – which will be labelled authentic Scottish gold. Between 15 and 20 groups have said they are interested in buying the gold, which will have a special stamp on it proving it is from Scotgold's mine.

Although many have panned for gold in Scotland's rivers, this will be its first goldmine and the only working commercial goldmine in Britain. The region sits on a geological belt containing gold that runs all the way from Scandinavia to Canada, across Scotland and Northern Ireland. Gold was discovered in the area in the 1980s but production got off to a slow start after the price of gold crashed.

Scotgold took over the project in 2007 but failed to secure enough cash to get it going. But since getting planning permission in 2018 the company said it has been given 'moral support' from the Scottish government and was promised a grant of up to £430,000 for job creation. It has also received overwhelming support from residents of the local towns, Tyndrum and Crianlarich.

The mine and the processing plant have been designed to have a minimal impact on the national park, which is home to red deer and has some of the best preserved oak woodlands in Scotland.

The site will use machines operated by people to extract the rock, rather than individuals digging at the walls. It is accessed via a tunnel that has been built into a hill called Beinn Chuirn. The mine will create more than 60 jobs at the peak of production, which is expected in 2022.

SOURCE: *MailOnline,* 25 October 2020

Earthquake hits Swedish mine

The Swedish National Seismic Network has reported that at 3 am on Monday 18 May a large earthquake of magnitude 4.1 – a little less than the 4.3 earthquake

measured at Skane, southern Sweden in December 2008 – struck the northern Swedish mine at Kiruna. The epicentre was 3km from the mine at a depth of 1,146m in the mine's footwall.

At the time of the quake there were 13 people underground. No one was injured, but LKAB, who own the mine, say inspections have found substantial rock falls and damage to water pipes.

The mine has been temporarily closed as the water level is rising, but they had managed to get the pumps working. After-shocks hampered the inspection work, but they had subsided by the end of Tuesday to "more nominal levels".

Underground in the Kiruna mine

The mine at Kiruna is reputed to be the largest and most modem underground iron ore mine in the world and is currently over 1,000m deep. It is renowned for the number of seismic events which are attributed to mining activity. It is not known when production could restart.

Kiruna is LKAB's largest mine, producing 14.7 million tonnes of finished products in 2019, compared with 9.6Mt from Malmberget and 3Mt at Svappavaara (other mines owned by the company).

The Kiruna municipality announced plans in 2004 to move the town 3km to the east to enable the long-running mine underneath it to continue operating.

SOURCE: *Below* – Journal of the Shropshire Caving and Mining Club, Summer 2020

Pumps are stopped at Poldark Mine

To reduce running costs during the current Coronavirus lockdown, the Poldark show mine turned off its deep mine pumps in April. The museum has had no revenue since they closed at the end of the 2019 season last October.

As a result of stopping the pumps the two staircase shafts are now flooded. They are still pumping water from the upper level of the mine and this has been diverted, via flexible hoses placed across the lawn area, into a small pond which then feeds into the main pond on the site. By doing this it is keeping the main pond at its normal level and helping prevent the water in the ponds and watercourses from becoming stagnant.

It is planned to reinstate an old bypass pipe, which is concealed, so the temporary hoses can be removed.

The museum is also carrying out additional work on the gardens and various structures. Hopefully they will be able to reopen in 2021.

SOURCE: *Below* – Journal of the Shropshire Caving and Mining Club, Summer 2020

Collapse at Great Condurrow Mine in Cornwall

A ten-metre deep and several metres-wide hole has opened up in a private garden near to a private unsurfaced lane in Beacon, near Camborne. The landowner and Cornwall Council have fenced the area, but the hole keeps growing and is preventing access to several properties, including two new builds.

It is believed that the collapse is associated with stoping on the Llandower Lode of Great Condurrow Mine, which was worked for copper ore and tin between 1850s and1913. Lane's Shaft is about 20 metres south of the collapse.

Much of the area of Great Condurrow Mine is now built over with extensive shallow mine workings hidden beneath roads and gardens. This is the third mining collapse in the area within a week. Experts at Terraflrma, a ground hazard and geodata specialist firm, have been called in to assess the situation. Various utility pipes and cables have also been exposed by the collapse.

SOURCE: *Cornwall Live News* and *Below* – Journal of the Shropshire Caving and Mining Club, Summer 2020

Cornish miners hope to profit from the shift to electric cars

In the middle of the 19th century copper miners at Wheal Clifford, now the site of picturesque ruins not far from Redruth in Cornwall, chanced upon waters rich with lithium. At the time there was no commercial use for the metal.

The underground springs were a nuisance they had to work around. These days lithium is an essential component of the batteries that drive electric cars, and deposits across Cornwall are attracting prospectors. Locals hope for a revival of the county's mining industry, two decades after its last metal mine closed.

Two companies with different approaches are investing. Cornish Lithium plans to extract the metal from brine it will retrieve by drilling wells. It is building a pilot plant a short walk from Wheal Clifford that will be ready within 18 months, says Jeremy Wrathall, its boss.

Wheal Clifford

British Lithium, a competitor, says it will get its product by crunching up rocks from a quarry it wants to dig outside St Austell. Roderick Smith, the company's chairman, says that hole will be "big but not gigantic", in an area that has already been scarred by china-clay works. Both teams talk of starting commercial production in three to five years.

Global demand for lithium is expected to increase five-fold in the next 15 years, as petrol and diesel cars give way to electric ones. At present most of it comes from Chile, Argentina and Australia.

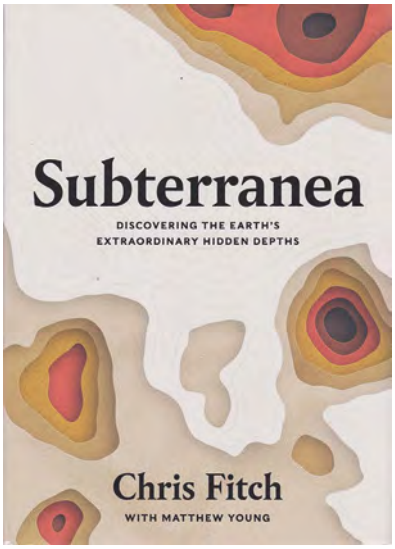
A lot of it must pass through China for processing. Most analysts agree that there will eventually be enough to go round. But carmakers worry that there will be bottlenecks as production expands, and are keen to see a more diverse bunch of suppliers.

SOURCE: *The Economist,* 3 October 2020

NEWS – PUBLICATIONS

Subterranea: Discovering the Earth's Extraordinary Hidden Depths

FITCH, Chris, with YOUNG, Matthew, 2020, Wildfire (Headline Publishing Group), 226pp,
[ISBN: 9781-47-227232-4] £25



Book Review by Martin Dixon

Chris Fitch, formerly Senior Staff Writer at the Royal Geographic Society, has produced a volume describing a wide range of exceptional underground spaces and structures. It shares the same title as our own magazine and the association is appropriate as most of the book is right up (or should that be under?) our street.

Forty sites in total are featured, spread across all six continents; the earliest sites are natural caves that date back thirty million years (not all spaces are man-made but as they have been explored and in many cases occupied, they are by definition man-used). The earliest evidence for man-use is cave art from more than 30,000 years ago; the most recent locations represent 21st-century projects such as the Svalbard Global Seed Vault in Norway.

Genres featured include Art, Civil Protection, Military, Mining, Occupation, Religion, Storage and Transport. A number of the locations are rightly recognised as UNESCO World Heritage Sites. The textual content is considerably enhanced by Matthew Young's splendid maps and plans; as well as being very clear, they also include scales and a north arrow (features sadly lacking from many other plans).

An interesting angle is taken with the London Underground – majoring on the discovery and excavation of cemeteries and plague pits during construction work – which is particularly topical given Crossrail and current HS2 work. One new learning point for me was that in southern Brazil there are prehistoric paleoburrows – excavations made by the extinct giant sloth, some of which were then used by humans for storage or ritual purposes.

The book is well proofread and I only spotted a very few minor errors. For example, the wartime shelter at Down

Street is described as a temporary bunker for Churchill rather than as its major role throughout the war as the Headquarters of the Railway Executive. The underground city at Derinkuyu in Turkey is said to have housed 20,000 people – a figure I've never seen any primary source for and which is perhaps an exaggeration.

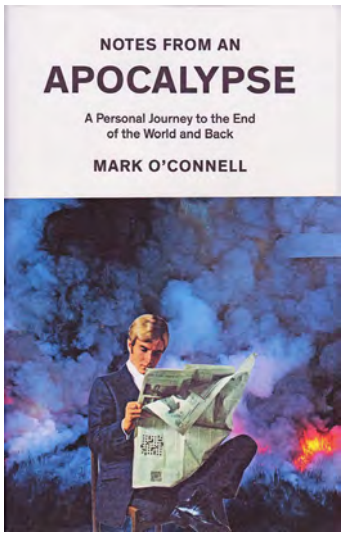
One slightly irritating aspect of the layout is that the book's design features much white space which could usefully have been used to add a little more depth to each subject. There are some excellent photographs but they are exclusively stock shots rather than new images taken for the publication.

Overall, the book does a great job of exposing the vast range of underground site types – many of them likely to be 'out of reach' to most due to their distant location (e.g. Coober Pedy in Australia) or difficult access arrangements (e.g. Burlington). From a personal level, it was great to be reminded of some favourite sites (Herculaneum in Italy and the Elephanta Caves in India for example) at a time when travel restrictions mean they remain effectively out of reach.

If you prefer a subject to be dealt with at a micro level, then this probably isn't for you but if you want to tour the world and turn up some new sites – and persuade friends and family of the wonders that lie beneath our feet – then it most certainly is.

Notes from an Apocalypse

O'CONNELL, Mark, 2020, Granta, 252pp. [ISBN 9781-783784-06-6] £14.99



Book Review by Martin Dixon

Mark O'Connell voyaged around the world (and virtually into space) to explore what the end of the world might look like and how it might be avoided by those rich or savvy enough to prepare for it.

The book starts promisingly by describing the juxtaposition of videos of two bears: one a saccharine cartoon bear being watched by his young son, the second the sour reality of an emaciated polar bear on YouTube scavenging for food.

The contrast between these two triggers the author to consider the reality of today's world versus the naive optimism of children. The volume ends in a cheesy scene which suggests that a happy nuclear family is perhaps the best (only?) protection against global war, civil disobedience, asteroid strike or other doomsday scenario.

In between these odd metaphors there is much stimulating discourse, providing some real insights and thought-provoking propositions. O'Connell visits ardent 'preppers' and their underground bunkers in South Dakota; the isolated countryside of New Zealand; a conference on populating Mars; a Scottish retreat; and (as an example of what the end of the world may look like) Chernobyl and Pripyat.

Some of the characters he meets reminded me of a Louis Theroux interview but others share his outlook about the extent to which individual wealth and selfishness threaten to eclipse the whole future of our society.

The book isn't all doom and gloom and there are some welcome lighter moments and humour to balance what is, in any analysis, a pretty depressing topic. I also learnt some new acronyms along the way, starting with a SHTF (Shit Hits the Fan) situation and leading up to TEOTWAWKI (The End of the World As We Know It).

However, a couple of aspects of the book marred my enjoyment of it. Firstly, having produced a proposition (for example that the majority of US 'preppers' are white fantasists striving to recreate the colonial conquests of their antecedents), the same point is repeated without really adding any new insight. Repetition of an argument without developing it does not necessarily make the point any stronger. In one of many references to other authors' works, O'Connell criticises one author (Ballard) as being 'a bit repetitive' – an unintentional and ironic piece of self-analysis.

Secondly, the book is verbose and the author rarely uses a short phrase, instead falling back on a paragraph of purple prose. It's also one of the few books I've recently read where I needed a dictionary at hand to unpack some of the content. I certainly wasn't aware of exactly what '*eschatological zeitgeist*' was, and now I've looked it up I'm not necessarily that much wiser.

As a longer example, what about *'Moldburg was the intellectual progenitor of neoreaction, an antidemocratic movement that advocated for a kind of white-nationalist oligarchic neofeudalism – rule by and for a self-proclaimed cognitive elite'*. Exactly, I couldn't have put it better myself.

A milder criticism is the use throughout (from an Irish author) of American English. To be fair the book was initially published in the USA but I always find that US spellings detract from my enjoyment. Lastly, a few photographs would have helped lift the book a little, rather than leave all the scenes described merely in the imagination.

Recent events across the world – most especially the Covid pandemic – suggest that the end of the world is as likely to be caused by creeping paralysis rather than sudden annihilation. Like the author, I doubt whether any of the scenarios painted in the book offer a realistic end game for the survival of the fittest and we should instead focus on (re)building a strong and mutually supportive society where shared destiny eclipses personal ambition.

As the author himself might have said: It behooves our neighbors to catalyze our collective response to impending disaster. (!)

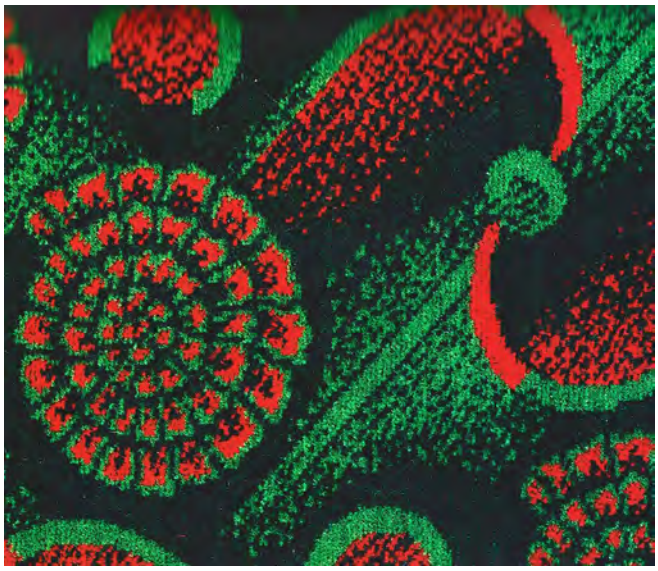
Seats of London: A field guide to London Transport Moquette Patterns

MARTIN, Andrew, 2019, Safe Haven Books Ltd, 192pp. [ISBN 9781-9160-4531-6] £12.99

Book review by Martin Dixon

This is a delightful book on an intriguing facet of London Transport – the history and range of the patterned seat covers across the network. It's a fascinating niche and I found it much more compelling than, say, rivet counting on Josher-bowed narrowboats or valve gear on GWR locomotives.

The word *moquette* is French for a carpet, being a woven pile fabric in which cut or uncut threads form a short dense cut or loop pile. As well as giving it a distinctive velvet-like feel, the pile construction is particularly durable, and ideally suited to applications such as public transport. London is lucky in that its transport system generally uses sprung and padded seats rather than the harsh plastics of many other urban networks.



This moquette, in the pattern known as Trilobite or Fossil, was designed in 1958 by Jack Thompson and Richard Eatough. The dominant reds and greens follow a long tradition, with red representing the city and green the countryside. It was designed for the Metropolitan line and the pattern can still be seen in the London Transport Museum, retrospectively fitted in a 1900 Metropolitan Line carriage. (London Transport Museum Collection)

This compact book gives a brief introduction to the topic and then continues with illustrated two-page spreads for well over fifty different designs of fabric. Most of the patterns have an official or more colloquial name, including such beauties as *Trilobite, Handcuff* and *Barman*. The illustrations are excellent and each pattern has a 'rarity indicator', indicated by a number of seats on a scale of 0 to 5 (some patterns never hit production, hence the zero).

Interspersed with the description of the patterns and the vehicles on which they first appeared is information about aspects such as manufacturing details, the designers involved and other welcome snippets. The vehicles that carried moquette include buses, trams and special fleets (eg BEA Airport coaches) as well as all our favourite underground lines.

The short index is necessarily selective but as an example the range of topics covered under 'F' includes *Flanders and Swann; Flying Boats*; *Flying Scotsman, Margaret Fonteyn* and *Frangible Joints*! The whole volume, which draws heavily from London Transport Museum's moquette archive, is well produced and can be read cover to cover, dipped into randomly or used as a reference guide – hence the subtitle of the book. The cover is eye-catching if a little gaudy, featuring as it does 16 different designs in the same train carriage.

The structure of the book with short pieces of text alongside each image leads to a slightly disjointed approach with lots of page references pointing both forwards and backwards. It also means there is a small amount of duplication across the volume in (for example) describing organisations and job titles. The author occasionally lapses into the first person which comes across a little strangely in a reference book but arguably adds to the quirkiness of the publication.

All in all, Andrew Martin has written an intriguing book that has opened up a facet of London's public transport (and the LT Museum's moquette collection) to a wider audience and he easily succeeds in hitting his sitting target.

Nuclear War in the UK

YOUNG, Taras, 2020, Four Corners Books, 126pp

(ISBN: 978 1 909829 16 9) £10

Book Review by Martin Dixon

Sub Brit member Taras Young has drawn from his extensive collection of Cold War leaflets and handbooks

for this recently published volume. It covers the period immediately after World War II right through to the 1980s and essentially covers the readiness of government and the population for the civil defence of the UK. As such 'Preparation for Nuclear War in the UK' would perhaps have been a more descriptive title.

The text and illustrations show the different approaches by authorities and organisations to the nuclear threat over time. In the beginning, anodyne reassurance was perhaps a dominant theme, later tempered by the true horror of what an all-out nuclear strike may have produced. Both of these opposing treatments were somewhat constrained by the fact that many leaflets weren't publically issued at the time but would have been made available in what was expected to be the increase in tensions before conflict.

The range of leaflets covered is wide and is the real strength of the volume. The graphical treatment is fascinating and ranges from locally produced handouts to some of the best post-war poster art. A dominant (literally striking!) image is that of the mushroom cloud - somewhat ironic as by the time of a nuclear strike we were all meant to be tucked away in our inner refuges of unhinged doors and sandbags!

In the latter years of the Cold War, many local authorities declared themselves 'Nuclear-Free Zones', perhaps most notably the GLC (Greater London Council). This symbolic action belies the fact (to quote an Allied WWII propaganda leaflet) '*Fortress Europe has no Ceiling*'. This differing regional approach made it all the more difficult to produce a national response to the threat - a characteristic recently echoed in the differing rules for Covid-19 containment made by different areas of the UK.

The book's chapters cover bodies such as the Royal Observer Corps, WRVS, Post Office and Local Authorities but some of the text is on the short side. The chapter on Armed Forces for example has only nine lines and concentrates on the protection of the Armed Forces themselves rather than their role in the prevention, detection and response to a nuclear strike. After the build of the early chapters, the last 20 pages or so are a pictorial climax, with leaflet after leaflet mirroring the potential unfolding of a full nuclear attack and the potential gazetteer of targets.

It would have been good to include the role of the Regional War Rooms (later RSGs and RGHQs). Although there are fewer examples of information/publicity/propaganda material from these, the pamphlet *Danger! Official Secret* covering the exposé of RSG6 (Warren Row) would have added an interesting dimension, as would some of the imaginative posters and pamphlets from the Greenham Women's Peace Camp.

The book is well produced and laid out although the chapter headings are a little lost and the images are variously captioned on the same, previous or following page (or in a couple of cases, not at all). The book has stout hardback covers and as such represents excellent value for £10. A short index would have been a useful addition, but there is a short list of follow-up reading including Sub Brit's website as a general source of more information.

Many of us lived through the period under analysis but few would have been aware of the wide range of publications produced over the years to protect (or at least to reassure and sometimes to scare senseless) the population. Taras follows in a long line of Sub Brit members who have captured their knowledge and enthusiasm in print and the volume is a welcome addition covering a new angle on the UK's preparation for the Cold War.

NEWS – TUNNELS AND TUNNELLING

World's longest immersed tunnel under construction

After more than a decade of planning, work has begun on the world's longest immersed tunnel. Descending up to 40 meters beneath the Baltic Sea, Fehmarnbelt Tunnel will link Denmark and Germany, slashing journey times when it opens in 2029. The tunnel, which will be 11.1 miles long, is one of Europe's largest infrastructure projects, with a construction budget of over €7 billion.

Climate change has made car makers rethink how transportation will function in the future. What will the passenger car look like?

By way of comparison, the 31-mile Channel Tunnel linking England and France, completed in 1993, cost the equivalent of £12 billion in today's money. Although longer than the Fehmarnbelt Tunnel, the Channel Tunnel was made using a boring machine, rather than by immersing pre-built tunnel sections.

It will be built across the Fehmarn Belt, a strait between the German island of Fehmarn and the Danish island of Lolland, and is designed as an alternative to the current ferry service from Rødby and Puttgarden, which carries millions of passengers every year. Where the crossing now takes 45 minutes by ferry, it will take just seven minutes by train and 10 minutes by car.

Artist's impression of the tunnel portal

The tunnel, whose official name is Fehmarnbelt Fixed Link, will also be the longest combined road and rail tunnel anywhere in the world. It will comprise two double-lane motorways — separated by a service passageway — and two electrified rail tracks.

Today, if you were to take a train trip from Copenhagen to Hamburg, it would take you around four and a half hours. When the tunnel is completed, the same journey will take two and a half hours.

SOURCE: *CNN*, 19 October 2020

Progress on London's super sewer

Tideway, the company constructing London's new 25km super sewer known as the Thames Tideway Tunnel, has an interactive online map showing the current locations of its tunnel boring machines (TBMs).

This expansion of London's sewer network is due to be finished by 2024. Two sections – from Fulham to Acton and from Battersea to Fulham – have already been completed. There are 24 construction sites in London, from Acton in west London to Beckton in the east. The six TBMs are all named after women from history who lived or worked near Tideway's construction sites.

Rachel breaking through into the Acton storm tanks

The latest machine to complete its work, TBM Rachel, was named after Rachel Parsons (1885–1956), an engineer and advocate for women's employment rights who set up the first women-only engineering company in Fulham in 1920, Atalanta Ltd in Fulham Road.

At the start of the First World War she replaced her brother as a director on the board of their father's Parsons Marine Steam Turbine Company. She was found dead on 2 July 1956 and an ex-employee stableman named Dennis Pratt was convicted of her manslaughter.

Website: www.tideway.london/tbm-tracker/

SOURCE: GLIAS *Newsletter*, November 2020

Tidenham Tunnel – track lifted and conversion to shared use path

In September I got involved in the volunteer effort to 'tidy up' the 1.1km long Tidenham Tunnel just outside Chepstow to be able to reopen it as a walking and cycling route between Chepstow and Tintern.

Although the plan was originally started by Sustrans over 10 years ago, delays with permissions and licences meant that they lost their funding for the project. More recently, Greenways and Cycleroutes have picked up the project and have spent the last couple of years working on the tunnel and track-beds either side to prepare it for reopening which is due in April 2021 after the bat hibernation season.

Photo Simon Lockhart

Through the tunnel, the track has been lifted and moved to the Dean Forest Heritage Railway. A new tarmac surface has been laid through the entire length, low level lighting installed, a new protective 'roof' over the path at the central ventilation shaft, and several alcoves bricked up to create safe bat habitats. Gates have been installed at each end of the tunnel to allow the tunnel to be closed overnight to prevent disturbance of the bats.

SOURCE: Simon Lockhart (Sub Brit member)

Could the Dundee Law railway tunnel become a major tourist attraction?

Dundee Law boasts a tunnel which was carved though the hill in the early 19th century. It was blocked up in the 1980s but there are hopes it might be given a new lease of life.

Railway track, air-raid shelter and mushroom factory – Dundee's Law Tunnel has had many uses. Opened in 1831 as part of the Dundee and Newtyle Railway, it was a feature of the city's landscape for 150 years. The two main entrances were blocked off in the 1980s after fears over safety were raised and the tunnel was abandoned.

It lay there, unloved and forgotten, until community members started campaigning to reopen it as a world-class tourist attraction. However the discovery of harmful gases which prevented access for those without safety gear has resulted in any plans for the disused tunnel being put on the back burner.

The north end of the Law railway tunnel was excavated, surveyed and reburied in connection with nearby building work in 1981.

But that doesn't mean the campaign has been forgotten – far from it. Campaigners, inspired by similar railway tunnel projects across the UK, are still hopeful that one day, the Law Tunnel might be unlocked as one of Dundee's finest hidden treasures.

The story of the Law Tunnel begins in the late 1820s and it's inextricably linked to one of Scotland's very first railways – the Dundee and Newtyle Railway (D&N). This was the first passenger railway in the north of Scotland and the first not to rely on coalfields for the bulk of its traffic.

The D&N railway had several unusual features in its journey across the considerable heights of the Sidlaws. Rather than going round them, engineer Charles Landale decided on a policy of "up and over", and this resulted in three inclines – at Dundee Law, Balbeuchly and Hatton.

The inclines were worked by stationary steam engines while coaches and wagons were pulled by horses over level stretches of line. Later, steam locomotives – the first in Scotland – were used, although horses provided back-up if they broke down. The construction of the railway was complicated by the decision to build a tunnel through the Law, which was finally completed in 1829, allowing the 11-mile line – and of course the tunnel – to open to traffic on 16 December 1831. Next year will be its 190th anniversary.

The tunnel in use as an air-raid shelter

The tunnel was only in use for 30 years. Uneconomic and time-consuming to operate, it closed in 1861 when the line deviated via Lochee. The tunnel was reopened by the Scottish Mushroom Company for growing purposes in 1898, but the company went into liquidation in 1902. Five years later, botanist Sir Patrick Geddes, a pioneer of the Green movement and modern town planning, drew up plans for the tunnel as a fernery, along with elaborate plans for the surrounding area.

It was converted to an air-raid shelter during the Second World War before its entrances at Kinghorn Road and Keats Place were blocked off in 1983. It remained open albeit not officially – for generations of local children to climb into it. The two entrances were eventually blocked and housing was built over the Law Tunnel. It is now accessible only via a manhole cover and shaft on the south side.

When artist Deirdre Robertson began campaigning to have the Law Tunnel reopened in 2014, she was hopeful it might be a "world-class visitor attraction" one day. However, the major issue, besides poor air quality, is access. If these issues can be overcome, who knows what the future might hold.

SOURCE: *The Courier,* 12 November 2020

Stonehenge tunnel approved

A controversial plan to dig a £2.4bn road tunnel near Stonehenge in Wiltshire has been approved by Transport Secretary Grant Shapps. The A303, a popular route for motorists travelling to and from the southwest, runs within a few hundred metres of the World Heritage Site. The plan to build a two-mile tunnel out of sight of the monument was approved despite objections.

Some environmentalists and archaeologists had voiced their opposition to the plan due to its potential impact on the area. In June, it emerged that a team of archaeologists had discovered a ring of at least 20 large shafts within the ancient religious monument, a short distance from the stones. But Highways England said the finds were "well outside the scheme boundary" and no closer than 500 metres from the planned road upgrade.

This transformational scheme will return the Stonehenge landscape towards its original setting and will improve journey times for everyone who travels to and from the southwest.

SOURCE: *BBC News,* 12 November 2020

HS2 tunnelling begins

With all the delays, spiralling costs and protests up and down the country, you might have thought HS2 was going nowhere fast. In fact, the controversial project has been quietly tearing up swathes of the Buckinghamshire

countryside – and is now set to tunnel under the Chilterns.

In November two giant 2,000-ton, 558ft-long machines arrived in the UK, where they will soon begin burrowing. The machines will have to drill through ten miles of chalk and flint to complete the tunnel, which will begin near the M25 and end near South Heath in Buckinghamshire.

Described as a 'defining moment in the history' of the high-speed rail link, they will dig as deep as 295ft below ground for three continuous years. The machines were built at the Herrenknecht factory in Germany and have been shipped in pieces to the UK, before being transported to the Chilterns.

The tunnels will be 29.5ft in diameter and lined with concrete as they go. The tunnel-boring machines will convert chalk and dust into slurry which will be treated and used for landscaping.

Each has a 'cutterhead' at the front which rotates up to 3.2 times a minute as it drills through the earth, collecting material which will be moved backwards via a conveyor belt. Each machine will remove 2.7 million cubic metres of earth and rock. They will both have up to 17 crew members, plus 30 in the tunnel behind, and are steered by tiny adjustments to hydraulic 'rams' that grip the tunnel wall to move forward.

The first tunnel begins on the HS2 beside the M25 at Denham in Buckinghamshire. Photo Chris Gorman

The Chiltern Hills passenger tunnel will be the UK's longest, measuring a third of the length of the Channel Tunnel. The digging will help form phase one of the high-speed line, which will connect London and the West Midlands.

There will be 32 miles of tunnel in this phase, with the longest and deepest being the Chiltern Tunnel. The London tunnels will be 13 miles long, with a maximum depth of 164ft.

SOURCE: *MailOnline,* 12 November 2020

Late News

Rescue from Box mine in the early hours

Four 'foolish' men were at the centre of a dramatic three-hour rescue operation after they became lost during a night-time underground adventure exploring Box mine. Teams of firefighters, police and Ministry of Defence police were alerted at 1am on 17 November when the four lost men found a part of the mine with faint mobile signal.

Once located, the four men were passed water and blankets through one of the access points but it was still a long walk through the tunnels by the specialist search and rescue team to find them and then lead them out safely. It was not until 4am that the rescuers were able to lead them to safety following the escapade, which police described as 'more than a little foolish.'

The drama happened after the young men had decided to explore the mine workings in the dark and without proper equipment and in breach of Covid restrictions. They realised they had to call for help after becoming hopelessly lost underground. It took over an hour for rescuers to locate their exact position, and it was 4am before they were brought to safety.

SOURCE: *MailOnline*, 19 November 2014

Kent mum starts campaigning to save WWII tunnels

Kayley Page from Northfleet, Kent, raised concern about a housing development in Crete Hall Road which could impact a network of underground wartime tunnels running below. Kayley, along with other concerned locals, used local railings to hang up photos of the history of the area to raise awareness of their concerns.

Constructed by telegraph cable company WT Henley in 1939, the twisting passages were used as an air-raid shelter to shield from German bombing during the Second World War.

SOURCE: *KentOnline*, 29 November 2020

Kiev Metro: a Stamp of Approval

Martin Dixon

In Kiev, as part of a visit to Ukraine to explore Chernobyl, I took the opportunity to tour the Kiev Metro, the third system to be constructed in the former Soviet Union (after Moscow and St Petersburg). It first opened on 6 November 1960 and now extends to three lines, 52 stations and 68 kilometres of track. Some of the stations mirror the grandeur of their Moscow antecedent – this is hardly surprising as the two schemes had architects in common. *Zoloti Vorota* (Golden Gates) station on the green line is particularly grand, with vast arched platforms illuminated by a swathe of bronze chandeliers.

The impressive illumination at platform level on Zoloti Verota Station. Photo Martin Dixon

From a subterranean viewpoint, perhaps most impressive is *Arsenalna* Station, which is situated on the original Sviatoshynsko-Brovarska (red) line dating from 1960. Its claim to fame comes from being the deepest Metro station in the world, at a staggering 105.5 metres. The station is named after the neighbouring Kiev Arsenal which dates from the 18th century (unlike London's Arsenal station which is named after the football team so in a sense both are related to shooting). The platforms are reached by two flights of apparently endless escalators, the journey taking around five minutes.

Later in the trip I popped into the equally impressive Central Post Office in the city – located off Independence Square and itself replete with stained glass and chandeliers. It's well worth a visit and a wander round. Part of the building houses a small philatelic bureau and I was pleased to see and buy a set of four stamps commemorating the 50th anniversary of the Metro System in 2010.

The set includes two stamps of 2.00 Hryvnia and two of 1.50 Hryvnia. Two stations are featured, Lukianivska and Dorohozhychi – an external shot of the former and the entrance hall and escalators of the latter. Somewhat surprisingly, both stations date from more recent schemes, opening in 1996 and 2000 respectively and both are on the Syretsko-Pecherska (green) line. I guess the authorities were keen to parade recent achievements rather than Soviet legacy.

The escalators at Arsenalna Station stretch into the distance and the ascent to street level takes around five minutes. Photo Martin Dixon

The other stamps feature tunnel construction and a modern Metro train. They are both forward looking rather than retrospective, the train being produced by the Kriukiv Railway Manufacturing Plant in Kremenchuk, Ukraine. They first entered service in 2009 and are slowly replacing the 1970s build Soviet stock.

The block of four Ukrainian stamps issued in 2010 showcase the extensive Kiev Metro and Ukrainian engineering.

The Rudder of Corsica

Sharon Brown

October 2018 found us on holiday in Corsica, and visiting the southern medieval clifftop citadel of Bonifacio. The 13th-century Bastion de l'Etendard houses a small museum with exhibits of the town's history. The King of Aragon's Stairway (*l'Escalier du Roi d'Aragon*) is unusual, and well worth a visit.

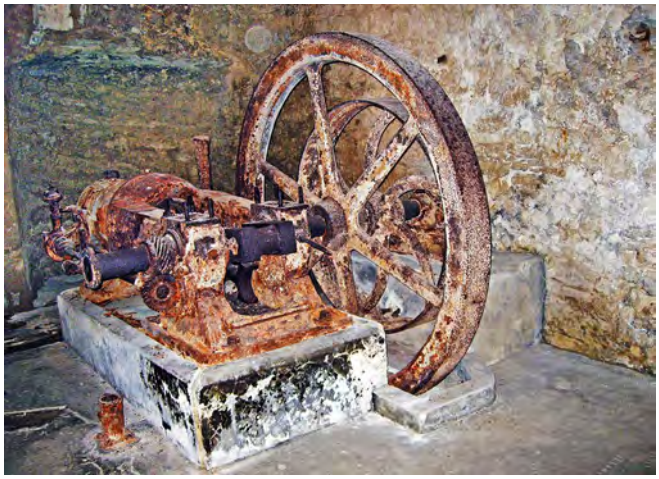
Descending 187 steps carved into the cliff face, a covered path just a few metres above sea level guides you to some excellent vistas and, although not accessible on our visit, the Saint-Barthélémy soft water well – which is no longer in use.

On the way back to the car park, a large sign displaying the words *VISITE DES SOUTERRAINS ET DU GOUVERNAIL* caught our eye, and not being able to resist anything underground, we immediately headed over to take a look.

The advertised not-to-be-missed underground experience was to visit tunnels and galleries in a rock that local fishermen named the Rudder of Corsica as its look and position at this southerly point of the island is reminiscent of a ship's rudder (*gouvernail*). The rock is detached from the cliff and the Blokhaus within is 10 metres above sea level.

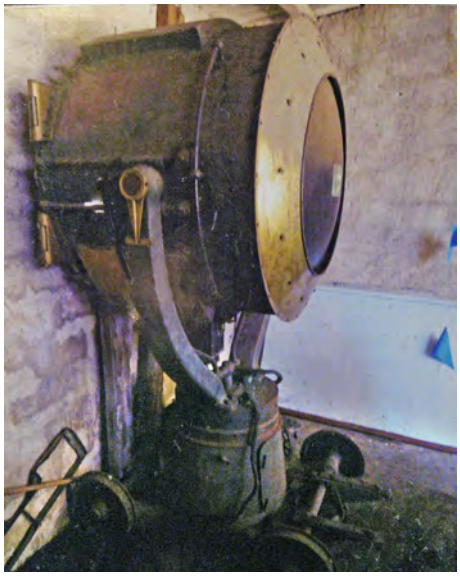
VISITE DES SOUTERRAINS
ET DU GOUVERNAIL
Ne quittez pas la Corse sans avoir visité
son gouvernail :
Pointe extrême de l'île.
Ce tunnel creusé à main d'homme vers 1880
aboutit sous un énorme rocher situé à 10m au dessus de la mer.
Sa position unique offre une vue exceptionnelle
sur l'entrée du port de Bonifacio et la Sardaigne.
Ne manquez pas cette visite originale
"Le Gouvernail de la Corse"

Heading inside, we found a small cafe and shop and the 168 stairs leading down into the tunnels themselves. Originally dug out around 1880 by French military engineers, the entry tunnel leads into several galleries, the first of which housed an electricity generator which provided power to the facility. Although a lot of the original fixtures have rusted, there is evidence of the occasional insulator and wiring throughout.



As with many military installations, other galleries were used to house ammunition, and the remains of shell hoists for the surface batteries are evident. The areas are now home to a small display of mostly WWII artefacts.

At the end of the tunnel we emerged into a chamber which housed a powerful searchlight. The searchlight, which was mounted on a rolling trolley, would be retracted from the aperture by way of an extant rail system during the day to allow for servicing and safekeeping. The remains of the trolley and the steel shield protecting the portal are also still present.



The searchlight had a 12km range which could reach the coast of Sardinia to the south, and was used for surveying the entry to the Port of Bonifacio and the straits between the two islands. The Straits of Bonifacio were a strategic passage for Italian and German warships during WWII, and this facility was developed by both of these countries' armies during their respective occupations in that conflict.

For the cost of a few euros, this made for an interesting detour should fellow members find themselves in what the French call *l'Île de Beauté* (the Isle of Beauty).

Discovering the Maginot Line: The Thionville Fortified Sector

Clayton Donnell

The French, for good cause, feared the Germans would again use poison gas against them in the next war. The Maginot Line forts and casemates were equipped with powerful ventilators to pump fresh air throughout the fort. If poison gas was detected, the incoming air was bypassed through these SP36 type filters - combination paper and charcoal - pictured here at Ouvrage Galgenberg. Photo Dan McKenzie

In the late summer of 1988 I was in the US Air Force, stationed at Ramstein Air Base, Germany. One weekend I hopped in the car and decided to go and "find" the Maginot Line in northeast France. I knew this mysterious entity was only 45 minutes away, just across the French border, but I had no idea what I was looking for. I crossed the frontier – I assume now it was the road to Lembach – rounded the corner, and, just as I expected, there it was. Or at least it looked like... something concrete, on the side of the road.

Well it turned out to be a storm drain. I looked around, embarrassed, to make sure no one had seen me, got back in the car and drove on. Using my Michelin 1:100,000 road map (all that was available at the time) I noticed some star-shaped symbols in a village called Lembach. The map key said *Castle, Bunker*. Good enough for me – at least it didn't say ... *or storm drain*. In the centre of Lembach a sign pointed to the *Ligne Maginot* and a couple of miles down the road another sign *Ligne*

Ouvrage du Four-â-Chaux in the Vosges Fortified Sector. Photo from Michel Grami collection

Maginot Four à Chaux pointed to the left. I had found my first *ouvrage*.

The works

Now, 32 years later, it's much easier to find the Maginot Line, but when you examine the map page of such excellent websites as wikimaginot.eu, or lignemaginot.com, you will probably be quite shocked at its vastness and complexity. The largest structures are the *ouvrages*, which translates literally from the French as 'works'.

These are vast underground forts, completely self-sufficient and with well-protected artillery positions. There are 45 large forts (*gros ouvrages*) and 97 smaller ones (*petits ouvrages*). The largest forts were garrisoned by over a thousand troops and had everything from their own hospitals to wine cellars for the officers.

Ouvrage du Four-â-Chaux, Bloc 6.
Photo from Michel Grami collection

However, the Maginot Line is not just a line of forts (although they are, in my opinion, the best part, especially the abandoned ones). It is a massive network of thousands of elements that not only supported the forts in the late 30s into 1940, but mostly still exist.

This supporting infrastructure includes barracks, casemates, machine-gun posts, anti-tank defences, ammunition and supply depots, narrow- and standard gauge railways, and power and telephone networks. These can and should be visited, if one really wants to know how it all worked. Where to begin? First a brief history.

The defence of France

On 3 August 1922, the *Commission de Défense du Territoire* (CDT) – was created with General Adolphe Guillaumat, Inspector General of the Army and member of the *Conseil Supérieur de Guerre*, serving as President. Seven months later the CDT finished its mission and presented a 36-page report to the Defence Minister*: Rapport au Ministre sur les principes de l'organisation défensive du territoire*.

This report drew two conclusions: the defence of France should be based on the development of fortified regions with a dual purpose – defence of the frontier and as a place to launch an offensive by the armies; and it should be based on a system of permanent fortifications built along certain parts of the frontier.

General Henri Berthelot, former military governor of Metz, identified the most dangerous potential invasion routes, one being across the plateau of Lorraine, and the commission concluded that it would be necessary to build permanent fortifications in three *Régions Fortifiées* (RF):

- RF Metz
- RF Lauter
- RF Belfort.

André Maginot, the French Minister of War, agreed but was particularly insistent that his beloved Lorraine was of primary urgency and pushed his colleagues over the funding finish line. Hence the defensive system has been named after him to this day.

RF Metz included the giant underground battleships (which is what the capabilities of the *ouvrages* mirrored) Rochonvillers, Molvange, Metrich, Hackenberg, and Anzeling; the smaller but just as forbidding Soetrich, Kobenbusch, Galgenberg, Billig, Mont-des-Welsches (my favourite) and Michelsberg. Plus the infantry forts of Immerhof, Bois-Karre, Oberheide, Sentzich, Mont-du-Coucou, and Bois-de-Bousse. A visit to these places is enough to keep one busy for weeks.

The unique Munitions Entrance to Kobenbusch. Note the 60cm rail line leading into the fort from the munitions depot. Photo from Collection Frontières du Nord-Est - Facebook

The sector (*Secteur Fortifiée* – SF) of Thionville was the most powerful sector of RF Metz (RF Metz was dissolved on 18 March 1940 and folded into XLII *Corps d'Armée de Forteresse* (CAF), which is why you don't see that nomenclature used any more).

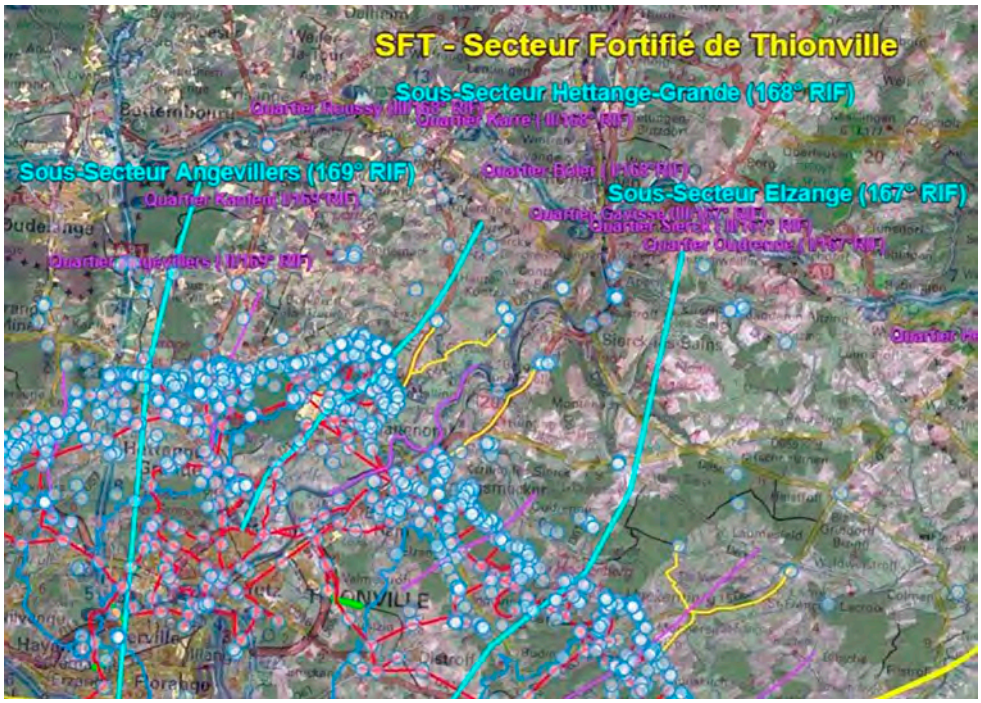
The Men's Entrance to Ouvrage Galbengerg.
Photo from Morten Jensen collection on Flickr

SFT was positioned between SF de la Crusne on the left and SF de Boulay on the right. Its left flank extended from just east of Rumelange, through the village of Rochonvillers, and across the Fensch valley to Lommerange. Its right flank ran from Remeldorff, between Freistroff and Chémery-les-Deux to Neudelange.

The Forêt Communale de Cattenom sat astride the sub-sectors of Hettange-Grande (home to the interval troops of 168 Régiment d'Infanterie de Forteresse (RIF)) and Elzange (167 RIF). Today, the forest is most noted for the four cooling towers that rise above the trees – the nuclear power station Centrale Electrique de Cattenom. But the forest also hides the object of this article.

Ouvrage Galgenberg – an eye-opening tour

In the late 1990s I had the pleasure of visiting Ouvrage Galgenberg, identified as A15, the "A" signifying *ouvrage* (fort), and 15 indicating the 15th fort along the line beginning with A1 – Ouvrage du Fermont. The guide, Philippe Schmalz, showed me round the *ouvrage*, then I climbed into my rental car and followed him down a nicely paved road until we turned off onto what can only be described as a mud and rut-filled horror fit only for horse or tractor (glad I took the full rental insurance coverage). This led to the Casemate Sonnenberg (C47 – need I elaborate about the C?).


SFT - Secteur Fortifié de Thionville
Sous-Secteur Hettange-Grande (168° RIF)
Sous-Secteur Angevillers (169° RIF)
Sous-Secteur Elzange (167° RIF)

This map depicts the vast number of Maginot Line elements in the SFT. As you can see, much more than just a few forts and casemates. You can visit this map at wikimaginot.eu and zoom in to see the details

Anti-tank rails that preceded the Main Line of Resistance of the Maginot Line. Photo from Michel Grami collection

Back in civilization we stopped at the small infantry fort Ouvrage Oberheide, too overgrown to see, whose entrance was blocked by a boulder, then past the intriguing entrance block of Ouvrage Kobenbusch, and finally the Abri Bois de Cattenom (X14). Oh, along the way we stopped at an armoured, underground telephone junction chamber (probably 26T), then wandered into the woods to see the structures and trenches built by the men of the 168th Régiment d'Infanterie de Forteresse (168 RIF). Is that all? Not yet.

That trip made me realise, just in a little stretch of forest, how vast the Maginot Line truly was. Over the years, returning to the area and joining trips arranged by my friend, our late and beloved Dan McKenzie, I learned about and saw many more of these elements. If you're unfamiliar with the structures built to support the combat mission of the Maginot Line, I hope you will find this fascinating and, even though not everything is accessed by underground tunnels, make a visit some day.

I will now describe what you can find (some of it is still there, some has disappeared) in the region south of the Luxembourg border that comprised the SFT (*Secteur Fortifiée Thionville*). There are way too many elements involved to cover the entire SFT so, starting at the border we will draw an imaginary (often curving) line 30km in length, through Cattenom to the south of Thionville, and review all of the bits of the Maginot Line that one can find in just that narrow stretch.

The Thionville Fortified Sector

There are, according to Wikimaginot, 919 fortified elements contained in the Thionville Fortified Sector. The Cattenom salient, which is not an official sector of the line, straddles the S/S (Sub-sector) Hettange-Grande and S/S Elzange, the former with about 300 elements, the latter 250. It would take up the rest of this article's space just to list each one, but Wikimaginot has already done that for us, so take a look for yourself at their Cartography or sector list. The majority still exist, which is good news for us. Are they easy to find? Not necessarily.

Is there any interest in visiting an underground *Chambre de Coupure* (switching room) or a PC (*Poste de Commandement* – Command Post) of 167th RIF that still has the regiment's insignia carved over the doorway, or an old concrete railway platform hidden deep in the woods? Well, now that you mention it – maybe. Probably not on the same thrill level as wandering around an abandoned Ouvrage, unless you are interested in the Maginot Line as a whole. And hopefully if you finish this article you will be more interested than you were a few moments ago. Let's take a look at the organization and composition of the Line.

Elements of the Line

The Maginot Line was broken up into a series of functional lines, all supporting the Main Line of Resistance (*ligne principale de résistance* or LPR) where you can find the big boys – the artillery and infantry forts and heavy casemates.

Ouvrage Galgenberg's machine gun turret in Bloc 3. Photo from J. Pavel collection

The main roads leading into France from Germany and Luxembourg were manned by the *Gardes Républicains Mobiles* (GRM) – the border guard. These took the form of manned concrete outposts built along the main roads. The roads and bridges themselves were mined in the most important places with *Dispositifs de Mine Permanent* (DMP), concrete vaults loaded with explosives. The roads were also blocked by heavy metal barricades that could be raised or lowered. This was the tripwire line designed to sound the alarm in case of invasion.

It's easy to say, "Hey, wouldn't the French army have known long before the Germans crossed the border that they were about to be invaded?" Well, no, they didn't. *Fall Gelb* – literally 'Case Yellow', the German Invasion of France – began very early in the morning of 10 May 1940 and some of the French High Command staff didn't even bother to get out of bed to find out what was going on. The invasion was a total surprise, the tripwire became a critical element, but the Germans didn't cross over into SFT for quite some time and they would do so from the west.

Moving on; a line of advance posts was constructed between the GRM and LPR, in the villages and along the main roads. These were either built into existing dwellings or were separate bunkers equipped with anti-tank guns and machine guns to slow the enemy advance towards the LPR. In SFT there are the GRM blockhouses. You'll find a line of fortified houses above Sedan, and quite a few small blockhouses built into homes in the villages around Wissembourg in Alsace.

The GRM blockhouse at Roussy-le-Village. Same design and construction as Rodemack, Fixem, etc. Photo from Thierry Caland collection

The army built their interval defences in the form of infantry and anti-tank blockhouses and observatories. Next came the *petits ouvrages* and *gros ouvrages* and flanking casemates which represented the strongest fortifications of the main line of resistance. These were preceded by a continuous line of anti-tank rails and barbed wire that stretched across the entire sector. Isolated artillery observatories and interval troops shelters (designated as "O" and "X") were located behind the *ouvrages* and casemates.

A telephone coupling chamber similar to 26T. Photo from Thierry Caland collection

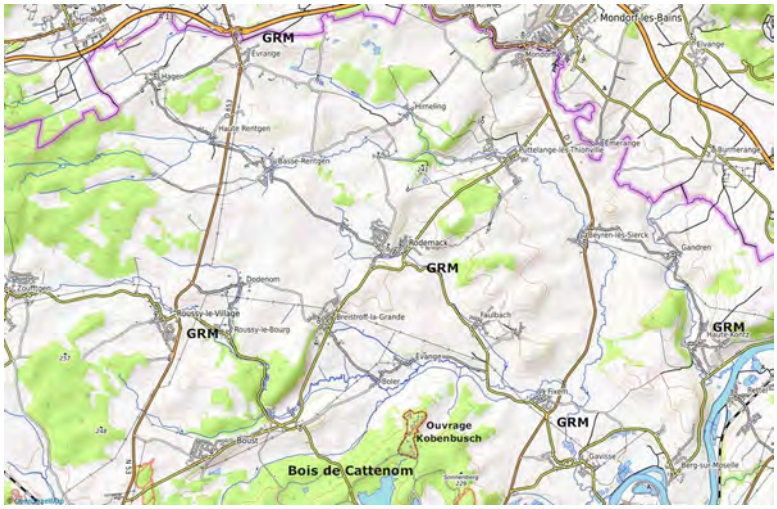
All of the forward elements were connected by an underground telephone system. Electrical power followed buried cable trenches connected to large concrete transformer stations several kilometres to the rear; these transformers stepped down the voltage from the civilian grid. A network of 60cm narrow-gauge railway track led from huge munitions and engineering supply depots located well back from the line, through miles of twisting pathways through wooded ravines and across streams to forward offloading depots and inside the large artillery forts.

During peacetime the soldiers and officers lived in large housing complexes built conveniently close to the line. Finally, the army built their own shelters, PCs, and small artillery and infantry bunkers.

Border crossing

Let's begin at the border. The Voie de la Liberté, otherwise known as the D653, crosses from France into Luxembourg a few hundred metres north of the village of Évrange**.** In May 1940, prior to arriving at the crossroad with D153H, one would come across *Barrage de Route* no.14. It was a simple steel barricade that could be dropped down and across the roadway. Unfortunately, like all of the other barricades, it no longer exists. You might find a block of concrete to which it was affixed but there is no record that any modern-day Maginophile has made such a search. Volunteers?

GRM blockhouse at Rodemack. Photo from J. Pavel collection



Showing from the border area to the LPR

About 25m further along, at the intersection, was *Dispositif de Mine Permanent* 73NM (it should be obvious by now that everything was categorized and numbered). Permanent means it was a concrete vault built underneath the road and filled with explosives.

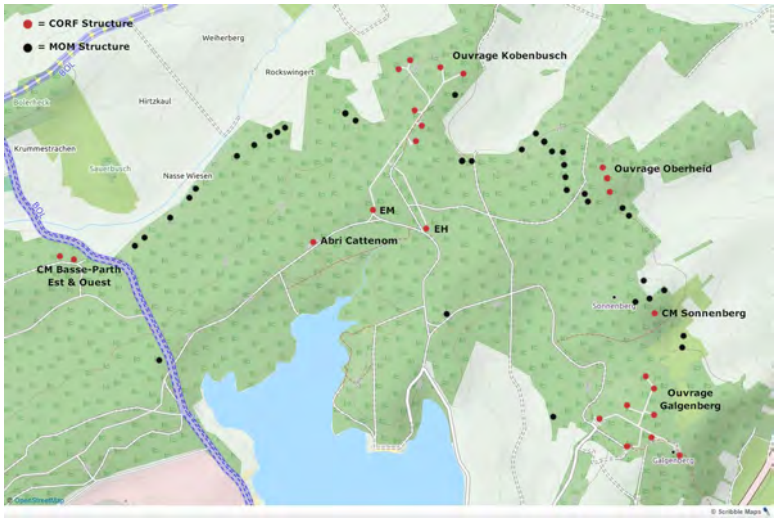
On 11 May 1940, Corporal Hariga, chief of the detachment tasked with setting off the explosives, reported that he received the order to blow up the mine from Lt Kaikinger at 0910hrs. It functioned perfectly, creating a crater 40 to 45m long, 25 to 28m wide, and 4-5m deep. Needless to say the vault was destroyed, along with part of the town. In the Sub-sectors of Hettange Grande and Elzange there were eight road barriers and about a dozen mine vaults (all have disappeared).

The next type of structure, the GRM blockhouse, is found about 4km from the border. The village of Rodemack is very interesting; not only is it quaint, but it is listed among the most beautiful villages of France. It is surrounded by a 15th-century rampart guarded by the Sierck Gate and medieval garden that runs along a creek. Very beautiful; I have been there.

Rodemack is about 10km from Sierck-les-Bains, another fortified town along the Moselle (the famous tri-point border village of Schengen is just up the road from Sierck).

The roads D62 and D57, two main roads that run between the border and Thionville, connect at Rodemack, Two DMPs assured destruction of the access to D57 and the Advance GRM Post Rodemack covered the road with automatic rifles. The detonator for the mines was located in the blockhouse. This advance post can be visited if you can find it hidden in the vegetation.

The GRM post at Roussy-le-Village (49.457843N : 6.177481E) is being restored and will provide a nice visit in the near future. Contz-les-Bains is in good shape (49.456239N : 6.346509E). There are a total of six GRM blockhouses in the two sub-sectors on the west bank of the Moselle.



Elements of the Cattenom Forest area (Scribblemaps)

At this point, if someone were driving down the D57 looking for the Maginot Line, they would probably be quite disappointed, unless they stopped for lunch at Rodemack and happened to stumble on the GRM post. Nine km from the border, we arrive at the village of Basse Parthe and turn left on to D56. There's a cool old tower in a cemetery and on the horizon you can see steam rising from four huge cooling towers of the Cattenom nuclear

power plant. We go over a rise and just ahead of us is a long stretch of woods extending to the northeast and southwest. This is where it gets interesting.

Twin bunkers

The D56 runs between woods on either side and continues past the nuclear plant towards the Moselle River. The Forêt de Garche, to the right, contains two CORF (*Commission d'Organisation des Régions Fortifiées*) bunkers: Basse Parthe Ouest (C45) and Basse Parthe Est (C46). These are the first elements of the LPR in the sector; C45 flanked towards the east with machine guns, an antitank gun (37mm) and a 50mm mortar. C46 had identical capabilities and also provided flanking fire to the east.

Basse-Parthe-Est. Photo from J. Pavel collection

Both bunkers have been cleaned up in recent years by a local association. If you were to wander past the casemates into the woods you would come across the anti-tank rails and barbed wire that ran along the entire sector. Each of the CORF elements was also surrounded by a belt of barbed wire entanglements.

Abri Bois-Karre entry. Original drawbridge is below. Ditch is guarded by an FM embrasure. Photo from Morten Jensen collection on Flickr

Only 900m from the twin casemates is the Ouvrage du Bois-Karre (A12). It is a beautiful monobloc, meaning it has a single artillery block but is one step up from a casemate. It is now a museum with a working twin machine gun turret, its principal weapon. (Working, as in, it raises and retracts, and revolves. I wouldn't be surprised however if it could be loaded and fired.) Note that 2.6km further to the west is the artillery fort of Soetrich. It is abandoned and supposedly the entrance is sealed off.

Between Bois-Karre and the casemates of Basse Parthe are a number of MOM bunkers (*Mains d'Oeuvre Militaire*, i.e. military-built works) built by the army for the interval troops. They include three observation posts, three infantry blockhouses, and two blockhouses for cannons. 300m back from this line is X12, the Abri Bois-Karre, a surface shelter built by the CORF for local troops. It could support a company, up to 210 men.

A series of MOM blockhouses in the Cattenom Forest. Photo from Collection Frontières du Nord-Est – Facebook

This is built on the surface most likely because of a high water table, rather than the underground version, the *Abri Caverne*. There is also the Abri Rippert (X13), another surface shelter, abandoned and open. We will now visit the Bois de Cattenom on the other side of the road.

Abri Rippert - X13 - a surface shelter located near Bois Karre for interval fortress troops. From Collection Frontières du Nord-Est - Facebook

About 500m after you enter the wooded area along D56, a forest road that leads into the Bois de Cattenom; it is the former military road that connected the forts. The sign along the road as you enter reads *Ligne Maginot et Plage*, so apparently if you get bored by the bunkers you can lounge on a beach along the Lac du Mirgenbach, a man-made lake that is used to draw water to cool the reactors of the nuclear power plant. (Maybe I'll swim somewhere else, thanks.) The lake wasn't there in 1940.

Small but perfectly formed

About 320m after the turn, on the left, in the woods about 60m in, is Telephone Coupling Chamber 26T. This is a small underground block with a trapdoor access. Inside are the remains of the telephone equipment which looks to be in fairly good shape. 600m further down the road on the left is the Abri Bois de Cattenom (X14), another surface shelter like Rippert which was built to shelter a company of interval infantry.

Interior of the coupling chamber. The equipment has all been removed. Photo from Thierry Caland collection

One of the troop dormitories inside an interval shelter - this one is X13. Photo from Thierry Caland collection

The shelter was on two levels and contained officers' quarters, six rooms for sixteen men each, a telephone switchboard, kitchen, motors for electricity, ventilation, latrines, washrooms, and storage for coal, diesel and food supplies. The shelter was defended by a ditch, FM *cloche* and casemates for machine guns. This shelter is maintained by the association LMSFBC and can be visited. This shelter has all of its equipment in place; X12 and X13 are of the same design and capabilities.

Another view of X13. Photo from Thierry Caland collection

Cb444 was a blockhouse located in the Rippert district near Bois Karre. Photo from Thierry Caland collection

Before moving further down the road to the one-time 'jewel of the forest', there are a number of fascinating bunkers located parallel to this forest road along the edge of the woods to the north. A walking path leads to this section so no machete is needed. These are more of the MOM blocs built by the army and intended for use by the interval troops.

Cb443 - Infantry Blockhouse. Photo from Thierry Caland collection

This particular location is outstanding as each of the blocks is just inside the edge of the forest. Each block is on a slight rise with a commanding view across the open fields to the north and was equipped with cannons or infantry weapons to combat whatever crossed the fields

or drove down the roads. The first was Cb228 – Bois de Cattenom 01, a blockhouse equipped with a 25mm anti-tank cannon that flanked to its left. Its field of fire was 1000m and it covered the Basse-Parthe casemates and the slopes of the Usselskirch ridge.

About 100m northeast is Cb226 – Bois de Cattenom 02, an infantry blockhouse with a machine gun that flanked the ground to the right. About 200m further is Cb215 – Bois de Cattenom 03, another infantry blockhouse for a machine gun that flanked left, followed the same distance further by Cb286 – Bois de Cattenom 04, an anti-tank blockhouse for 25mm cannon to flank to the right which enjoyed a great 1,000m field of fire.

Next is Cb436 – Bois de Cattenom 05, a gun pit for a 37mm TR Model 1916. The group of blocs begin again with Cb9 – Rockswingert, a blockhouse for 8mm Hotchkiss model 1914 machine gun. It is a construction identified as a Type RFM 35" blockhouse – built exclusively in the RF Metz.

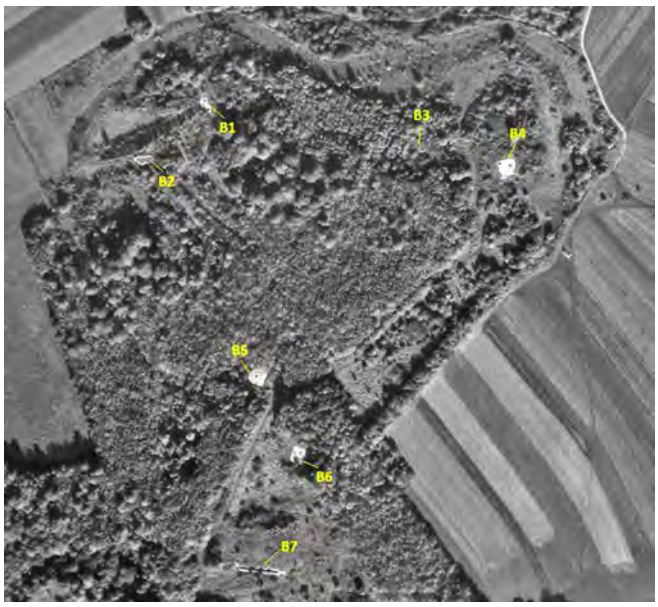
Cb435 – Bois de Cattenom 06 is another MOM anti-tank block. 100m away is O44 – Weihergraben, an artillery observation block with two entrances connected by a tunnel. It was used in support of regimental artillery batteries. Cb434a – Bois de Cattenom 08 is an infantry observatory consisting of a simple circular chamber with three viewing ports – very interesting. It was built using an old German snail sentry post (*guérite escargot*). The final point in this sector of the wooded salient is another gun pit for a Hotchkiss 8mm machine gun – Ct42.

MOM gun position for 25mm anti-tank cannon. Collection Frontières du Nord-Est – Facebook

Jewel of the Forest

I mentioned the Jewel of the Cattenom Forest. 280m down the road from the Cattenom shelter is the Gros Ouvrage du Kobenbusch (A13). This large artillery fort has two entrances, one for men and one for munitions, as is typical of this sector, and seven combat blocks.

The entrances were separated for good reasons. You didn't want the troops getting in the way of or getting run over by narrow-gauge locomotives filled with boxes of shells. The munitions entrance was used for the delivery of ammunition and supplies; it led to lifts or ramps to the main magazine of the fort – M1. The personnel entrance led down a staircase to the barracks and living area.



Aerial view showing the blocs of Ouvrage du Kobenbusch. Photo from Wikimaginot.eu

The Munitions Entrance to Ouvrage Kobenbusch. Includes an interesting outcropping on the orillon *protection in the embrasures . Photo from Morten Jensen collection - Flickr*

What I call the combat blocks are:

Block 1 – machine gun turret;

Block 2 – infantry casemate with MG and 47mm interchangeable;

Block 3 – artillery observatory;

Block 4 – MG turret;

Block 5 – 75mm turret;

Block 6 – 81mm mortar turret;

and finally the very interesting and exciting

Block 7 – artillery casemate for three 75/32 cannons.

All of these blocks have their firing positions in the woods north of the entrances. No idea how hard they are to find – spray for ticks. The munitions entry is unique and there doesn't seem to be an explanation for the design.

The men's entrance is a few hundred metres to the southeast. Unfortunately, Kobenbusch was the victim of Lac Mirgenbach's rising waters. It is not only inaccessible but only Lloyd Bridges in his scuba outfit (I'm dating myself here) could explore the lower depths. I suppose

Bloc 7 of Ouvrage Kobenbusch, consisting of 3 embrasures for 75mm/32 casemate cannons. Photo from Collection Frontières du Nord-Est – Facebook

Kobenbusch Bloc 2. Photo from Wikimaginot.eu

Men's entrance to Kobenbusch. This is completely sealed up due to flooding by the nearby lake used by Cattenom nuclear plant. Photo from Thierry Caland collection

the combat blocks which are higher up are dry but I have no information about that.

In between the Kobenbusch complex and Ct42 are two more components – Cb434b – Rockswingert Est 2, an infantry observatory, and Cb434c – Rockswingert Est 1, an infantry blockhouse.

Narrow-gauge railway – branches everywhere

South of the road in the direction of the lake are several interesting features. There is a small 60cm rail track leading out of the Kobenbusch munitions entrance; the track ends at the roadway but at one point it continued across the road and ran parallel to it, crossing the D56 where it continued on to the west. A couple of hundred metres from Kobenbusch a branch of the track leads off this main line towards Kobenbusch's personnel entrance. About 100m in, it splits into two parallel tracks and ends just short of the military road.

There is not much information about this part of the track but I suspect this branch was used to deliver munitions and supplies to where they were picked up by truck and taken to Ouvrages Oberheide and Galgenberg. It is unknown if there are any remnants of the track or the offloading platform. North of this double track is the light barracks of Kobenbusch, used to house fortress troops during peacetime; the barracks are in ruins but there are some buildings remaining.

The Maginot Line rail system was quite amazing. The narrow track twisted for miles through the woods and ravines, the wagons driven by Péchot-Bourdon diesel locomotives. The Kobenbusch branch continued for 6km before it reached its first major junction.

The north (right) branch continued for another couple of kilometres to the Hettange Grande transhipment station. Here, supplies were delivered by standard railway wagons from distant supply depots and unloaded onto smaller wagons for transport to Soetrich and Kobenbusch. The left branch ran due south to another transhipment station where D153g intersects the railway line that runs to the south.

The transhipment platform at the Saint Hubert Depot. Photo from M. Prasil collection

The line then continues west through the Forêt Communale de Thionville, north of the Fort de Guentrange to the munitions depot of Schwerenberg, an intermediate loading and storage facility. Ammunition from the depot of Florange was brought here. The track continued to the large Marspich depot, located on the outskirts of Marspich, below D13; this depot supplied the local sectors.

There was also a supply depot for the engineering materials located next to Marspich. This was used for the storage of barbed wire, anti-tank rails, cement, and other construction and repair materiel. Marspich is 15km from Kobenbusch as the crow flies so it is a good indication of the immensity of the transportation system.

Finally, though not located in the sector, four main depots located at Mars-la-Tour, Ressaincourt, Romanswiller and Redig supplied the smaller locations. For a good look at one of the depots, check out Saint Hubert (49.284549N : 6.143423E). It is in the Bois de Saint Hubert.

Electricity, transformers and barracks

While we are now several kilometres behind the line, it is worth taking a look at the transformer station of Reinange, along the D60 just outside the village of the same name. From the road this looks like a Maginot Line casemate but is much longer and has no weapons embrasure. It was built by the CORF, thus the similarity. There were no proximity defences of the transformer stations so if the enemy attacked here the situation was already lost.

A transformer station similar to Reinange. This one is private and is now heavily modified by the owner, a farmer. Photo Dan McKenzie

The purpose of the station was to convert voltage from high tension to medium tension (65,000V to 10,300V). The medium tension was sent along both overhead and buried cable to the forts. This post cannot be entered; it belongs to the EDF company and is still in use for the civilian grid.

During our visit to the Maginot Line in 2003 we were fortunate enough to be able to drop by the transformer station of Xivry-Circourt in the Crusnes Sector (I believe we were on our way to Ouvrage Latiremont). The station was empty of its equipment. It was on private property but somehow we obtained the OK to look inside. I'm sure that Reinange was similar but most of the electrical equipment there has been upgraded.

The French constructed permanent barracks compounds all along the rear of the line. In SFT they appeared as multi-storey stone structures to house officers and NCOs. They are typically referred to as Casernes, or Camps de Sûreté, and were used to house the fortress regiments (a similar system operated along Hadrian's Wall two millennia ago).

They are close to the LPR – between one and four kilometres. In the Cattenom region the closest Camp de

A Camp de Surete like Hettange Grande or Cattenom, this one outside the village of Angevillers near the Ouvrage du Rochonvillers. Photo from Thierry Caland collection

Sûreté that still exists is Hettange Grande. The camp is 6km from Kobenbusch. Today it is perfectly preserved and refurbished and occupied by what looks like a French communications unit. This area is fenced and gated. Another section appears to be private dwellings. It is well worth a drive by as it looks like it did in 1940.

There was another very large camp identified as Cattenom located along D56 just southeast of the nuclear plant. It consisted of the Cité Cadres, a camp for officers. Nearby was the Cité Cadres for NCOs. The complex included an underground reservoir that was used until the 1950s to supply water to the Camp du Cattenom and later the town of Thionville. I suspect its use was terminated with the building of the nuclear power plant.

Ruins of the Camp de Cattenom - no trace remains. Photo from M. Teiten collection

Across the road from the former reservoir is a MOM shelter – Ellingen. Inside is a small chamber accessible

by two entries on each end. Possible uses include an air-raid shelter for the Cattenom camp.

The Cattenom salient

Just a stone's (or grenade's?) throw from the reservoir is the Observatoire d'Artilleries Cattenom. Its primary mission was to serve as an observatory to watch over the Moselle valley and the rear of the Cattenom salient. It was connected by telephone to the nearby artillery command posts inside the forts and was equipped with a GFM *cloche* – FM and 50mm mortar plus an FM embrasure to guard the approaches to the post.

Observation equipment included a *cloche VP* (*vision périscopique*) – with type B (12x magnification) and C (8x to 25x mag.) periscopes – yes, like a submarine – plus P8 emergency periscope for 8x magnification.

Cloche for periscope at Observatory Cattenom.
The flap on top swings over and the periscope is raised.
These were a particular target of German 88mm flak guns.
Photo from M. Teiten collection

The GFM *cloche* also has a type J2 periscope for 8x magnification. It was not connected to the civilian power grid so it was equipped with its own generator. The observatory is maintained by the LMSFBC and can most likely be visited upon request.

Let's move back into the forest and look at some more blockhouses before moving on to the final two ouvrages and a casemate.

MOM blockhouse in the Cattenom Forest.
From Collection Frontières du Nord-Est –

About 400m northeast of the Kobenbusch men's entrance is another cluster of interval defences. Cb425a – Dalem Ouest and Cb276 – Dalem Est are infantry and anti-tank blockhouses, respectively that sit in the woods and guard an area called Dalem, which may be a hill but appears to be a large open field. The former is MOM and the latter is an STG blockhouse (but still MOM – never mind).

MOM blockhouse in the Cattenom Forest.
Photo from Collection Frontières du Nord-Est – Facebook

Further along the edge of the woods in a section identified as Lonkich (a hill) are a number of MOM blockhouses for infantry and cannon (anti-tank), Cb204 – Lonkich 01 (MG) and Cb205 – Lonkich 02 (25mm anti-tank). The most interesting features are a few hundred metres south of these two blockhouses – the Sous-Quartier Boler – 1 Cie.

One of the Lonkich PC shelters for the Quartier Boler - note the remnants of 1 C^{ie} formerly in bright red over the door.
Photo from Collection Frontières du Nord-Est – Facebook

They are three *alveoles tôle metro*, that is, shelters built of corrugated steel. They are decorated very nicely with a painted "1 Cie" over the door. They served as the command post for the *sous-quartier*. If I recall correctly there are some trenches that connect the three bunkers.

Northwest of these are several bunkers with the designation "Oberheide", a hill now mostly hidden in the woods. The primary feature is the Ouvrage Oberheide (A14), which I will get back to in a moment.

The Oberheide elements follow a 45-degree line from Cb204 to the southeast; 100m from Cb204 is the Dalemerbusch Observatoire d'Artillerie, similar to the O44 Weihergraben, discussed above. Next in the line is the artillery observatory O45 – Oberheide. This was a regimental post not connected to the *ouvrage*.

The next six blocks indicate the importance of the position for observation. The first is Cb203 – Oberheide 05 – infantry blockhouse; Cb413-D – Oberheide 06, Cb413-C – Oberheide 04, and Cb117-C – Oberheide 03 are three infantry observation posts in a row. They are MOM blockhouses each with three viewing ports. Cb188 – C Oberheide - 02 and Cb119-C – Oberheide 01 are cannon and MG blockhouses. Finally is Ouvrage Oberheide.

Main gallery inside the Ouvrage Oberheide.
Photo from Matthieu collection

This is another block like Bois-Karre, equipped with a machine gun turret. This position is supported by Casemates Nord and Sud which aren't connected via underground to the *ouvrage*. Ouvrage Oberheide is equipped with two embrasures for interchangeable

Infantry Observatory in the Bois Karre.
Photo from Thierry Caland collection

MG/37mm anti-tank cannon, two for twin MGs, four embrasures for close defence (FMs), the MG turret, and four GFM cloches.

One of the cloches is equipped with a J2 periscope for artillery observation in support of – oddly – the Ouvrage de Metrich. This cloche is identified as Observation Post O18. The *ouvrage* is abandoned but under control of LMSFBC.

Some 200m further along the line are two additional MOM blockhouses – Rettelbourg 1 and 2 for cannon and MG. Further down are several elements identified as Sonnenberg – an artillery observatory, two MOM blockhouses, and Casemate Sonnenberg – C47.

Sonnenberg is an infantry casemate of CORF construction. It is a two-storey flanking casemate model 1930. Armament included one embrasure for twin MG, interchangeable with a 37mm anti-tank cannon; one embrasure for twin MGs; two embrasures for FM; two more for FM in a lower level to cover the ditch; and one *cloche* GFM for FM and 50mm mortar.

This is one of the original casemate designs. It is unique and identifiable for its FM that covered the ditch, later replaced by a *goulotte* chute grenade, a tube for firing a grenade down into the ditch. The structure is owned by the commune of Cattenom.

And so to Galgenberg

Finally we reach the Ouvrage du Galgenberg - A15, an intermediate-size artillery fort perched on top of Galgenberg hill and one of the best preserved. There are regular tours of its vast complex of tunnels and galleries, some forty metres below ground level.

Nicknamed the Guardian of the Moselle, Galgenberg has separate munitions and personnel entrances. The fort's crew included fifteen officers and 430 men. Each of the following blocks is sufficiently protected by GFM *cloches* for FM and 50mm mortar, MGs and 47mm anti-tank guns, plus additional MG and FM embrasures.

Block 1 (Casemate Northwest) – infantry casemate flanking towards village of Cattenom with *cloche* GFM (FM 24/29 at 50mm mortar model 1934), additional embrasures for interchangeable MG/47mm and twin MGs;

The gun chamber guarding the Men's Entrance to Ouvrage Galgenberg. Note the rail stretching across the room below the ceiling. The 47mm cannon hung on this rail and could be moved into position and switched out with the twin machine gun - now visible in the embrasure. The tube below the MG is for evacuation of spent shell casings. Photo from J. Pavel collection

The base of the stairs of the Men's Entrance. Note the FM blockhouse guarding the hallway leading to the main part of the underground fort. Photo from J. Pavel collection

The 81mm turret controls - Ouvrage Galgenberg Bloc 4. Photo from J. Pavel collection

Block 2 (Casemate Northeast) – flanks the direction of Sonnenberg with GFM *cloche* for FM and 50mm mortar, embrasures for twin MG/47mm and twin MG;

Block 3 – MG turret plus GFM *cloche* (FM and mortar);

Block 4 – 81mm mortar turret, GFM *cloche*;

Block 5 – Observatory with GFM for FM/Mortar, MG *cloche*, and observation *cloche* VP identified as O19;

Block 6 – 135mm *Lance-bombes* turret, GFM *cloche*.

Bloc 5 of Ouvrage Galgenberg - the observation block O19. Photo from Morten Jensen collection - Flickr

One final piece of information about Galgenberg: Ouvrage Kobenbusch did not have its own Artillery Command Post, therefore the PC at Galgenberg supervised the firing of Kobenbusch's artillery.

The ladder leading down into the cut-off chamber. Photo from Thierry Caland collection

In conclusion

We have now come to the end of our excursion. Most individuals who visit the Maginot Line only get a very small glimpse of the enormous and marvellous system it really was. From the transformer station to the depots hidden in the woods, old train tracks, concrete poles for overhead wires, underground junction boxes, small blockhouses, shelters, observatories, all the way up to the monstrous underground forts, this system teemed with activity from the late 1930s until about halfway through June 1940 and the fall of France. That's when the interval positions were abandoned by the army.

The trains no longer ran to and from the depots. All that remained were the fortress troops, locked down inside the forts they were now committed to defend until the very end. Eventually the Maginot Line was outflanked and completely surrounded.

The Germans attacked some of these forts for no particularly good reason, other than to think they would fall easily. Some of them did, like La Ferté and the forts of Maubeuge, and perhaps some of the Generals wanted to have a Maginot Line fort under their belt. They did not attack SFT or they would have had to deal with Hackenberg, Metrich, and the Cattenom salient.

Having said all that, let's go down to the village of Sentzich or Cattenom and have a beer.

Exact spot unknown. Cloche on a bloc of Ouvrage Kobenbusch. Photo from Collection Frontières du Nord-Est - Facebook

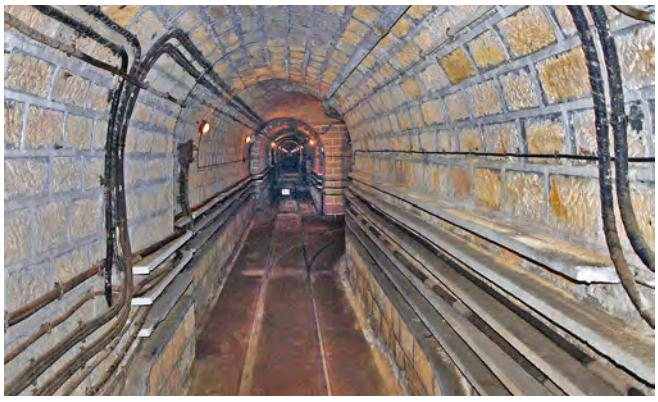
Editor's note: as soon as Covid restrictions sensibly allow, Sub Brit is planning to arrange a members' trip to part of the Maginot Line. Details will be announced by email and on the Forum in due course.

Glossary

CDT – *Commission de Défense du Territoire* (Commission for the Defence of the Territory)
CORF – *Commission d'Organisation des Régions Fortifiées* (Commission for the Organisation of Fortified Regions)
DMP – *Dispositif de Mine Permanent* (Permanent Mine Installation)
EDF – *Électricité de France* (energy supplier)
FM – *Fusil Mitrailleur* (Submachine Gun)
GFM – *Guetteur Fusil Mitrailleur* (Lookout and Machine Gun)
GRM – *Gardes Republicains Mobiles* (Border Guard)
LMSFBC – (*Ligne Maginot du Secteur Fortifié du Bois de Cattenom*)
LPR – *Ligne Principale de Résistance* (Principal Line of Resistance)
MOM – *Mains d'Oeuvre Militaire* (Military Works)
NCO – Non-Commissioned Officer
PC – *Poste de Commandement* (Command Post)
RF – *Région Fortifiée* (Fortified Region)
SF – *Secteur Fortifié* (Fortified Sector)
S/S – Sub-sector
STG – *Service Technique du Génie* (Engineering Department)
TR – *Tir Rapide* (Rapid Fire)
VP – *Vision Périscopique* (Periscope)

This small blockhouse with two embrasures for automatic rifle (FM) defended the inside of the munitions entrance at Galgenberg

Engine room at Ouvrage Galgenberg. This backup system consisted of 4 SGCM G3VU 42 motors with 125 CV of power



This tunnel at Galgenberg is accessible from the main gallery and leads to blocks 1 and 2 (straight ahead), and branches off to the right to block 3

The point at which the tunnel leading to Galgenberg's blocs 1 - 4 branches off of the main gallery. Note the branch tunnels were not finished off with stucco but show the original masonry

Lost Vietnam War Bunker discovered under luxury hotel, Hanoi

Stewart Wild

It not often that anyone spends three million on a Sunday lunch but I did in December 2018, with an ulterior motive in mind. It was in Vietnam where that amount in local currency – the dong exchanges at around 29,300 to the pound sterling – resulted in a charge to my Amex card of just over a hundred pounds.

I was in Hanoi, the capital of Vietnam, en route to Sydney, Australia and Christchurch NZ, and had stopped off for three days to explore the city's underground parts, and especially Ho Chi Minh's command bunker, newly opened to the public. Andrew Smith had given me some excellent advice.

Bomb shelter

Andrew also told me that one of the city's top hotels, the **Metropole**, had remained open for guests throughout the Vietnam War and that a lost bunker had recently been discovered under the hotel. The original hotel, built in French colonial style, had opened in 1901; the shelter had been built in the 1960s to keep guests safe during American bombing.

As the hotel remained open the staff were given military training

The hotel was reopened in 1992 by the now-communist government after extensive remodelling. This iconic establishment was now part of the luxury **Sofitel** chain which had continued to spend goodness knows how much to bring it up to world-class five-star luxury standard.

I made further enquiries. I was informed that there was indeed a newly discovered bunker, and that there was a daily guided tour, but that it was private and available only to hotel guests. As I already had accommodation in a lowly establishment about half a mile away, and the Sofitel room rates were well outside my price range anyway, I decided to try to blag my way in.

The plan was to have lunch in the Metropole's restaurant; thus I could claim to be a hotel guest. I didn't know at that point that Sunday brunch here was a grand and very expensive affair, a fantastic banquet aimed principally at top businessmen and diplomats and their families.

Nothing ventured, nothing gained

Sunday arrived. I entered the hotel about noon and was immediately greeted by a charming receptionist. "Can I help you, sir?" She could. "Is there a bomb shelter tour this afternoon?" "Yes, sir, at 5pm." Could I join it? "Are you staying here, sir?" "No." Could I join it if I stopped for lunch? She didn't know. The question had apparently never arisen before – the young lady would have to ask her boss, the Guest Relations Manager.

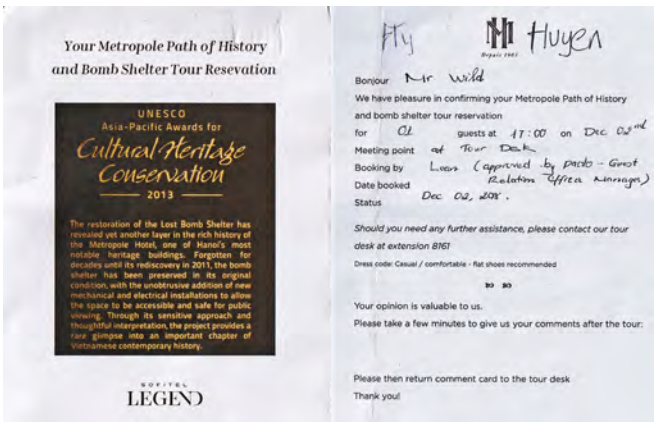
My name was noted and I was shown to a table in the adjacent very elegant *Le Beaulieu* restaurant. She would let me know later. A waiter brought the menus. Another waiter brought the drinks trolley.

On Sundays there was an unlimited brunch buffet, priced at around two million dong without drinks or just over three million with all drinks included. I was reassured that these prices included tax and service!

I couldn't back out now, and I still wasn't sure that they'd let me join the tour. But the buffet spread filling half the restaurant was the most sumptuous I had ever seen, the staff were efficient, charming and ever-present, and I was hungry and had over four hours to spare. What would you do? I opted for brunch including drinks.

The best lunch ever

I won't dwell on the magnificence of the repast or the drinks – my readers are only interested in the underground bunker. But the vast choice and quality of the buffet on offer and the range of top French wines with every course kept me very happy for the rest of the afternoon, and after an hour or so the receptionist reappeared with written confirmation of my place on the five o'clock tour. My cup runneth over.


Your Metropole Path of History
and Bomb Shelter Tour Resevation
UNESCO
Asia-Pacific Awards for
Cultural Heritage
Conservation
2013
LEGEND
Huyen
Bonjour Mr Wild
We have pleasure in confirming your Metropole Path of History
and bomb shelter tour reservation
Should you need any further assistance, please contact our tour
desk at extension 8161
Your opinion is valuable to us.
Please take a few minutes to give us your comments after the tour:
Please then return comment card to the tour desk
Thank you!

My place on the tour is approved

I presented myself at the tour desk a few minutes early, along with seven or eight other curious guests from all over the world. We were led through a door into the *Path of History,* a short passage whose walls were covered in photographs from the hotel's illustrious past, when celebrities like Charlie Chaplin, Somerset Maugham and

Graham Greene, not to mention royalty and countless Presidents, had all stayed here.

There was particular emphasis on the period of the Vietnam War, or as the Vietnamese call it, the Resistance War Against America, which had lasted nearly twenty years, from November 1955 to April 1975.

The Bamboo Bar

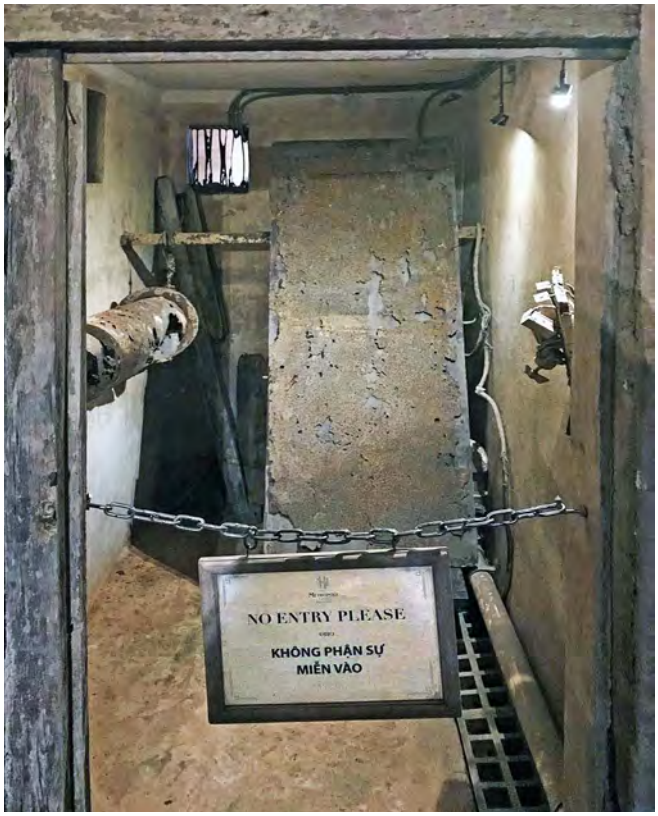
We emerged in sunshine into the hotel's massive inner courtyard, surrounded by four or five storeys of rooms with balconies which overlook a large and very inviting swimming pool. Between the reception area and the pool was a colourful array of comfortable chairs and tables with sun umbrellas – this was the Bamboo Bar.

It was while the hotel's workmen were clearing the patio for the remodelling of the bar area in 2011 that they had discovered what looked like the top of a blocked staircase. It didn't take long to clear it and the **Lost Bomb Shelter** – as they call it – was revealed. It opened for visitors a year later and received a UNESCO award for Cultural Heritage Conservation a year after that.

Stairs down to the bunker

At the bottom of the stairs there was a short corridor and three rooms

Our guide unlocked a small metal wicket gate and led us down the stairs. There was immediately that lovely musty smell familiar to all bunker devotees. Disappointingly, it was a bunker much like any other bunker, only a few feet below the surface, with a corridor, concrete walls and three 'rooms' off to the side, all stripped bare except for ventilation ducts, a few original electrical fittings (and some modern lighting). There was not even any graffiti.



Looking from the bottom of the stairs along the short corridor. The three rooms are seen, two of them with gas tight doors still in place,

Famous guests

Our guide informed us of some of the hotel's guests who had allegedly taken shelter here during periods of American bombing, or had checked it out as a precaution during quiet periods. One was Jane Fonda who controversially stayed in the hotel at the height of the war in 1972. Another was singer Joan Baez.

Our tour didn't last long unfortunately. I would have liked to have stayed longer but some of my companions were soon bored and our guide was not as knowledgeable as she might have been. We returned to the fresh air above and our guide locked the gate behind us. I found a comfortable chair with the group in the Bamboo Bar and was treated to a cocktail as I reflected on a rather enjoyable afternoon.

The end room still has some ventilation ducting and electrical fittings

Michael Portillo stayed at the **Metropole** and visited the bunker in 2019 while filming his *Great Asian Rail Journeys* tv series. I bet he didn't pay for lunch.

The Chard Canal and its Tunnels

Compiled by Nick Catford using text from Wikipedia

Lillesdon Tunnel looking south in May 2017. Photo Kevin Roach

The Chard Canal was a 13.5 miles tub-boat canal that ran from the Bridgwater and Taunton Canal at Creech St Michael, over four aqueducts, through three tunnels and four inclined planes to Chard in Somerset. It was completed in 1842, but was never commercially viable, and closed in 1868.

Before the canal

Prior to the construction of the canal, there had been several plans over the previous fifty years to build a ship canal from the Bristol Channel to the English Channel, in order to avoid the sea route around Cornwall and Devon.

The first which would have connected Chard to the canal network was a scheme surveyed in 1769 by Robert Whitworth, to link the River Parrett to Seaton in Devon. Whitworth was asked to reassess this route in the early 1790s, and again thought it was feasible. The plan was revived in 1793, while another route was suggested in 1794 by Josiah Easton, again passing through Chard.

The 1793 Chard Canal plan was revived in 1809, by now renamed as the English and Bristol Channels Canal, and the engineer John Rennie was asked to survey it in 1810. He advocated a small ship canal, suitable for vessels up to 120 tons. The cost of a barge canal had been estimated at £70,000, but Rennie's estimate for a ship canal was £1.33m.

Crimson Hill Tunnel north portal in June 2020. The portal is alongside a public footpath. Photo Kevin Roach

One further attempt to build a ship canal took place in 1825, when a canal capable of taking vessels of 200 tons, with a draught of 15 feet, was proposed. Thirty locks would have been required, on a canal from Stolford on the Bristol Channel to Beer on the English Channel, passing through Creech St Michael, Ilminster and Chard, at an estimated cost of £1.7m.

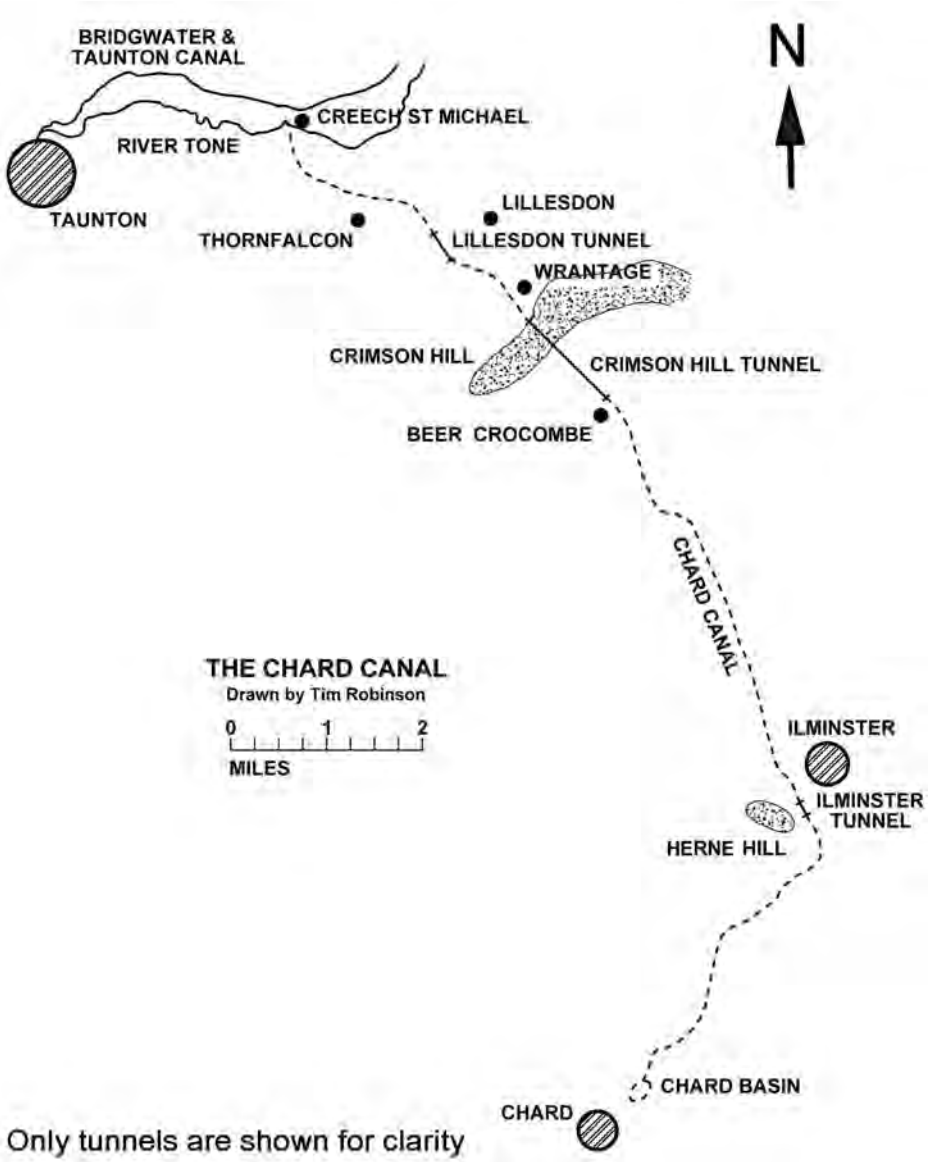
Thomas Telford produced the survey, an Act of Parliament was obtained on 6 July 1825, and although subscriptions of over £1.5m were promised, no further action occurred, with the Company disappearing after 1828.

Construction history

With the Bridgwater and Taunton Canal having opened in 1827, there was a further initiative to link Chard to it, and James Green carried out a survey in 1831. The route was 13.5 miles long, but with Chard some 231 feet higher than the canal at Creech St Michael; his plan involved two boat lifts, two inclined planes and two tunnels, and was costed at £57,000.

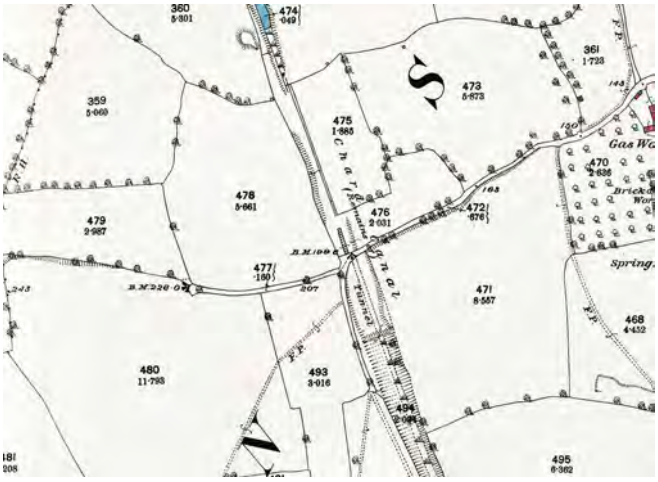
An Act of Parliament was obtained in June 1834, authorising the raising of £57,000, with an additional £20,000 if required, but local enthusiasm for the scheme was muted, and most of the capital was provided by just five men, all of whom were involved in the Bridgwater and Taunton Canal.

Work began at Wrantage in June 1835, but the Act did not allow parts of the canal to be built until tunnelling was well-advanced, and so work on the upper sections did not start until Autumn 1837. The 1800-yard tunnel under Crimson Hill between Beer Crocombe and Wrantage took two years to complete and is still today one of the longest in the country. The tunnellers began by excavating outwards from a central shaft. There were deaths due to collapses during the course of the work.



Ilminster Tunnel north portal in 1961

Green was replaced as engineer by Sydney Hall from the start of construction, and in view of the problems Green was experiencing on the Grand Western Canal with commissioning his boat lifts, Hall decided to replace the lifts with inclined planes instead.



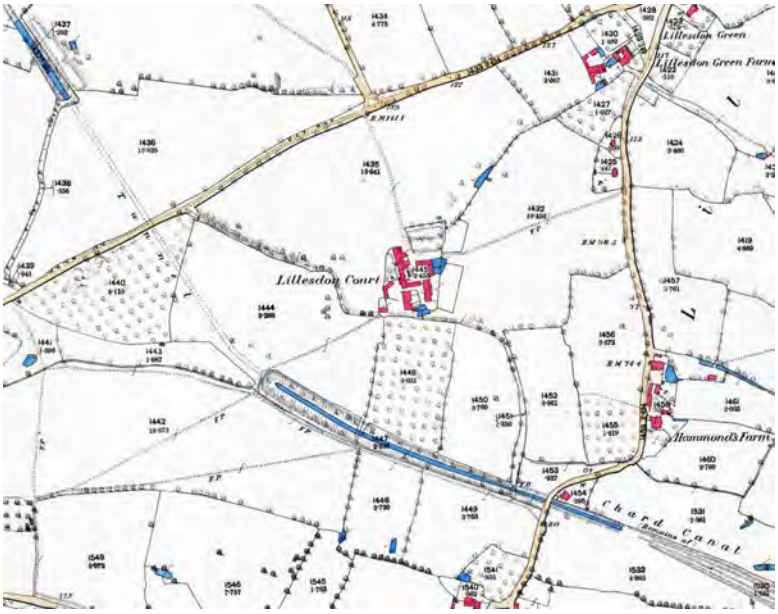
1889 1:2,500 OS map. By the time this map was published, the canal was already closed and largely dry. The Chard – Ilminster turnpike road running above the Ilminster Tunnel is now little more than a track

Further changes to the original plans were made above Ilminster inclined plane, where another tunnel under Herne Hill was constructed, enabling the line of the canal to be built at a lower level. It was originally intended

that the canal should cross the shoulder of Herne Hill in a deep cutting and pass 16 feet above the Chard–Ilminster turnpike road on an aqueduct.

Work on the Herne Hill cutting was started to a depth of some 10 feet before it was realised that the extensive embankment needed for this route all the way to Chard Common could be avoided by dropping the line of the canal so that it now passed through Herne Hill in a short tunnel before running under the turnpike road. A lock was added at Bere Mills, to raise the line by 7 feet and the length of the Chard incline was increased. The Ilminster tunnel was 300 yards in length.

Construction costs were much higher than anticipated, and another Act of Parliament was obtained in March 1840, allowing the Company to raise another £80,000 in shares, and to obtain a mortgage for £26,000, while a third Act in 1841 allowed construction to continue beyond the original seven-year limit. The canal opened to Ilminster on 15 May 1841, and to Dowlish Ford wharfs on 3 February 1842.



1889 1:2,500 OS map shows the Lillesdon Tunnel

There were delays caused by the rope on the Wrantage plane breaking, resulting in damage to the caissons, and further delays caused by the Bristol and Exeter Railway constructing their line under the canal at Creech, but the work was finally completed on 24 May 1842.

There were immediate benefits to the community, as coal prices fell, but the total cost of construction had been about £140,000, and as income was only a third of what had been projected, the canal company was never able to meet even the interest payments on its debts.

Operation

The canal was designed for tub-boats which were 26 by 6.5 feet. The inclines at Thornfalcon, Wrantage and Ilminster were double-acting inclines, consisting of two parallel tracks, each containing a six-wheeled caisson, in which the boats floated. A chain linked the two caissons together, passing round a horizontal drum situated at the top of the incline. Power for the movement of the boats was provided by over-filling the top caisson, the extra weight causing that caisson to descend and the other to rise.

Because the majority of traffic passed up the canal, and a boat displaces its own weight in water (Archimedes' principle), considerably more water passed down the incline than up it. However, the system was still more economical than using locks, and a large new Chard Reservoir supplied the necessary water.

The incline at Chard Common was quite different, consisting of a single track, with the tub-boats being carried on a cradle with four wheels . Power was supplied by a Whitelaw and Stirrat water turbine, with a 25-foot head, which used 725 cubic feet of water per minute. Boats were raised 86 feet in a wheeled cradle up a slope of 1:10. The cradle was attached to the turbine by a substantial wire rope, after breakages of the original rope.

The Ilminster tunnel was 14 feet wide, allowing boats travelling in opposite directions to pass, but the tunnels at Lillesdon and Crimson Hill were only wide enough for one boat. However the Crimson Hill Tunnel had a double-width 'passing area' about halfway through its course to allow passing of the boats from either direction.

The main cargoes were coal and stone. Traffic for the first three years rose from 25,835 tons to 33,284 tons, about two-thirds of which was coal or culm (anthracite). Competition started immediately, with the railway arriving at Taunton in 1842, and the Westport Canal being completed in 1840. Attempts were made to convert the canal to a railway, and an Act of Parliament obtained in 1847 changed the name of the Company to the Chard Railway Company, but successive plans were thwarted by the inability of the Company to repay its debts.

The railways take over

The canal went into receivership in 1853, after which there were discussions with the Bristol and Exeter Railway and the London and South Western Railway, with a view to building a branch to Chard. A new Chard Railway Company was constituted in 1860, and another Company was formed in 1861, to construct a branch from Taunton to Chard. The London and South Western Railway took over the Chard Railway, and the Bristol and Exeter built the branch from Taunton to Chard.

In order to prevent competition from the L&SWR, the Bristol and Exeter Railway bought the Grand Western Canal, the Bridgwater and Taunton Canal and the Chard Canal, so that the L&SWR could not. They paid £5,945 for the Chard Canal, with the takeover and closing of the canal being authorised by an Act of Parliament obtained in 1867. The receivers were discharged in February 1868, and it seems likely that the canal was closed then.

During World War II part of the Taunton Stop Line invasion defence project ran along the canal.

Remains

The canal aqueduct at Wrantage now supports farm buildings. The Chard reservoir, which was the main supply for the canal, was sold to local landowner Lord Poulett. In 1990, South Somerset District Council bought it, and it is now a designated nature reserve. Surrounded by woodland, it provides habitat for over 150 species of birds.

Ilminster Tunnel south portal in 1961. Although still visible the tunnel portal was largely blocked with rubbish by this date.

By January 2007 an area of disturbed ground was the only evidence of the south portal of Ilminster Tunnel. Photo Tony Etheridge

The remains of the inclines have survived over 140 years of neglect, as have two of the three tunnels – the condition of Ilminster tunnel is unknown. Near Lower Farm, a bridge on the Thornfalcon to Creech road is now a Grade II listed structure, and the three-arched aqueduct which carried the canal over the River Tone is largely intact, although it no longer has its parapets.

The tunnels today

Ilminster Tunnel North Portal – ST35681402

Ilminster Tunnel South Portal – ST35721390

Lillesdon Tunnel North Portal – ST29552345

Lillesdon Tunnel South Portal – ST29752310

Crimson Hill Tunnel North Portal – ST31102209

Crimson Hill Tunnel South Portal – ST32362485

In 1961 the North Portal of Ilminster Tunnel was still visible. By 2001 the canal bed had been filled leaving a few courses of bricks visible above the arch. Photo Kevin Bicester

When visited in 1967 the south end of the Ilminster tunnel was found to be completely blocked by rubbish tipping, although the cutting leading to it remained well preserved. On the top of the tunnel traces of a cutting, begun but abandoned, could still be seen. At the north end the brick entrance to the tunnel was well preserved but inside the roof was unstable.

After the canal was closed, a low dam wall with sluice and windlass was built across the tunnel mouth and could still be seen. North of the tunnel the canal was in the open for a few yards, with stone revetted banks. Today the north end of the tunnel has been infilled, with several courses of brickwork above the arch remaining visible. The south portal cannot be positively identified but an area of disturbed ground indicates its position.

1889 OS map shows the north portal of Crimson Hill Tunnel. Note the tunnel keeper's cottage nearby

At Crimson Hill the south portal is at the rear of Old Star Cottage. The owner has excavated the canal cutting and cut steps into the bank leading down to the tunnel where the water is two feet deep. There was an ill-equipped trip into the tunnel in 2005 using two children's inflatable boats with permission of the landowner. The intrepid explorers got little more than sixty yards before they had to retreat with a puncture.

Looking south a few yards inside north portal.
Photo Kevin Roach

Looking south from the mid-point, the tunnel isn't straight.
Photo Kevin Roach

Looking north towards the portal 80 yards in.
Photo Kevin Roach

Approaching the south portal the tunnel runs straight.
Photo Kevin Roach

Looking south 80 yards in. Photo Kevin Roach

Looking north from the south portal. Photo Kevin Roach

Looking north 100 yards in, it is now possible to stand.
Photo Kevin Roach

Farm irrigation pump in the south portal.
Photo Kevin Roach

Looking north towards the north portal. Approaching the first roof fall the canal holds little water. Photo Kevin Roach

Beyond the first roof fall the tunnel become unstable. Photo Glenn Bruce

Looking north towards the north portal. Photo Kevin Roach

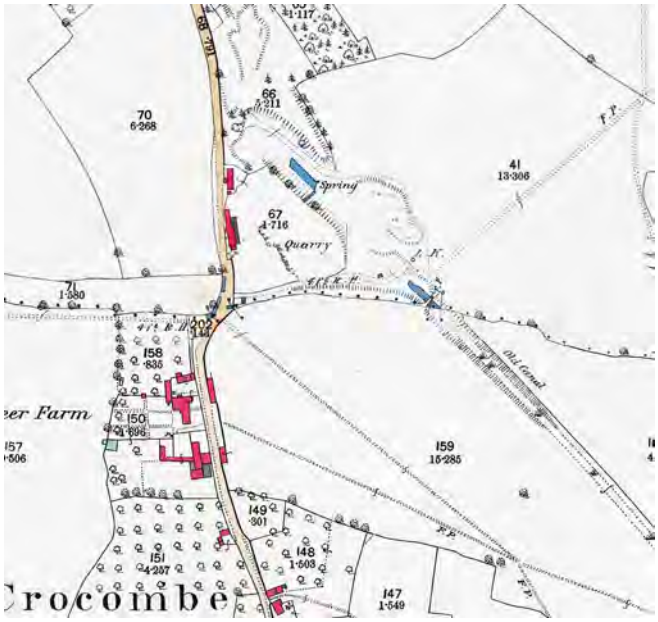
Beyond the first roof fall. Photo Glenn Bruce

Looking south towards the first roof fall. Photo Kevin Roach

The tunnel becomes badly misshapen between roof falls. Photo Glenn Bruce

A passing place after the first roof fall. Photo Glenn Bruce

Beyond the first roof fall the tunnel has fallen out in many places. Photo Glenn Bruce



1889 1:2,500 OS map shows the south portal of Crimson Hill Tunnel; the canal had been abandoned and was largely dry by this time. Old Star Cottage is immediately west of the tunnel portal

The northern portal at Wrantage is readily accessible via a farm track and footpath and is an interesting feature in the landscape. Nearby is an interpretation board that provides some background to the tunnel and canal's history.

Looking south along Crimson Hill Tunnel from just inside the north portal in June 2020. Photo Kevin Roach

Beyond the first roof fall the tunnel wall becomes far less stable as seen in this view from May 2010. Photo Glenn Bruce

The portal is gated but not always locked. A number of expeditions into the tunnel's north portal have been made in recent years but progress is stopped by a total roof fall after 400–500 yards. Kevin Roach's photographs from a solo expedition he made in June 2020 are reproduced here. Kevin went as far as the first roof fall. Other photos reproduced here were taken by Glenn Bruce in May 2010. Glenn climbed over the first fall and a second fall but his progress was eventually stopped by a wall of mud 1300 - 1400 yards into the tunnel.

Both portals of the Lillesdon tunnel can be seen. The north portal is heavily overgrown with only the top of the arch remaining visible. The tunnel is choked with mud and rubble but can be entered with difficulty using a belly crawl. Canal tunnel explorer Kevin Roach managed to make a solo trip through the tunnel in May 2017. His photographs are reproduced here. The south portal is open, and a farm irrigation pump has been installed in it. South of the portal the canal bed is dry.

The north portal of Lillesdon is choked with earth and rubble and only the top of the arch was visible in May 2017. Photo Kevin Roach

Progress south through Lillesdon Tunnel started with a belly crawl. After 100 yards it was possible to stand up. Photo Kevin Roach

A report of an expedition into the Crimson Hill tunnel was published in the Summer 2008 edition of *Belfry* (the bulletin of the Bristol Exploration Club). An extract from Bulletin 530 is reproduced here.

> As a long time resident of Chard I had been aware of the canal from childhood. The reservoir providing the headwater for the canal is now a moderately important

wildlife reserve and fishing lake. Land development has obliterated the old canal basin in Chard but its route can still be traced through the fields at a variety of locations. I visited the northern entrance more than 10 years ago and had wondered for some while how far it went. Rumour had it that the far end had collapsed. Nick Chipchase told me that he had struggled some way up it many years ago but that the thick clinging mud on the floor had defeated him.

A local bat group used to do a count in the tunnel by using an inflatable dinghy but they didn't venture that far in. Access is a bit debatable as well as at some time the landowner has obviously extracted water from the entrance area.

My interest was renewed when I got the opportunity to visit the southern end of the tunnel, which lies in the garden of Old Star Cottage in the hamlet of Beer Crocombe. Roger Clarke, the owner, had the old canal cutting in his garden but didn't start digging until a neighbour told him that he had a canal tunnel there! Pete Rose provided a humorous report on a trip to the tunnel in November 2004 (*Belfry* Bulletin 521, Spring 2005), and we planned to return sometime for more photography.

Further exploration

In the summer of 2007 I contacted Roger again and he told me that he had paddled to an earth choke some 500 yards up the tunnel (measured with string), the choke probably corresponding with the air shaft mentioned by Pete Rose. Feeling thwarted I decided to visit the northern end with a more reliable inflatable device, namely a canoe left to me by my late father and never used.

The tunnel initially remains in good condition and is easy to navigate with an inflatable. Photo Kevin Roach

The first day of September 2007 saw me, Philippa Glanvill and a friend of hers Christian Guppy pumping away at the entrance to the northern end preparatory to our first trip. We wore wet suits as well! The canoe proved helpful but as it could only accommodate two people, and that's at a pinch, progress was slow and made slower by the canoe grounding on the muddy bottom. The water in the tunnel for the first 600 metres was never more than thigh deep but the mud on the bottom was tenaciously glutinous making progress tiring.

The tunnel is surprisingly high, probably about 3 metres, and about 2.5 to 3 metres across with a high arched roof. In the first section there are shallow alcoves at intervals at about head height, which we surmised were drainage holes. Placed regularly along the roof are rusting structures resembling inverted pitchforks. At points where the drips from the roof were considerable some delightful orange stalactite and stalagmite formations could be seen. The odd lesser horseshoe bat could also be glimpsed high up in the ceiling.

Looking back towards the north portal the tunnel runs in a straight line. The recesses cut into the wall on both sides are a mystery. On a previous visit Glenn Bruce suggested they might be drainage holes. It has also been suggested they were for poling tub boats through the tunnel. Photo Kevin Roach

The tunnel runs on a bearing of about 140 degrees in an almost straight line and daylight can be seen from the centre more than 500 metres in. At this point the walls bulge slightly, probably more to do with ground movement than the construction methods used. At 600 metres the tunnel widens to about four metres and less than 50 metres later is the first collapse.

About 800 yards in and just before the rock fall; the canal holds little water and wading through the knee-deep mud was the only way forward. The tunnel widens here to allow two boats to pass. Photo Kevin Roach

The water emerges from the base of the collapse, which is overcome by climbing up into the space created by the roof fall before rapidly descending the far side. The rock is soft – a form of lias which contains big bands of calcite. It looks as if the collapse has occurred at the location of an old surface shaft and there is a very heavy drip here. Beyond the collapse the water is clear, green, chest deep and cold.

Martin Grass, Philippa and I returned at the end of November and surveyed up to the collapse. After a brief foray across the next section to a point where the passage narrowed again, Martin and I vowed to return with the inflatable canoe. In mid-December we were back again. The widened section is probably in total a distance of something like 60 metres or so and just beyond the left-hand wall has peeled away over a four-metre stretch.

It is rather alarming to climb up and peer into the space above the collapse. There is airspace running for as far as the eye can see in both directions above the tunnel roof! A stream trickling in has deposited calcite cementing the roof bricks together, which is slightly reassuring.

Beyond another wall collapse we entered the 'unknown', the canoe now being essential. I estimated the water depth to be something approaching two metres. A loud crunching accompanied our progress through a calcite raft stretching across the entire passage and extending several metres in front of us; this suggested few people had been this far.

Sadly about 200 metres from the choke we came to a solid bank of mud obstructing the passage. If the total length of the tunnel is 1800 yards I estimate there are about 400–500 metres of canal tunnel that are currently inaccessible. Digging would be feasible but one would be digging standing in cold water. Strong swimmers immune to cold or owners of inflatable dinghies can apply!

The first collapse. Photo Kevin Roach

It is possible to climb over the first collapse and continue south along the tunnel. Photo Glenn Bruce

Chard History Group published a small booklet on the canal in 1967, which was reprinted in 1988.

SOURCES:

Wikipedia – text copied under creative commons licence

Chard Canal – The Chard History Group 1967.

An underground stone quarry roof-fall in 1910 near Glasgow

Paul Sowan

Few people have actually seen a roof-fall in a mine, and survived to tell the tale, although more commonly people have been trapped underground the wrong side of falls (and, in many cases, rescued). Your scribe, and Nick Catford, were just missed by a few days by a fall in the Godstone Hill quarries some years ago. A passage here was open one weekend, and blocked the next (it has now been dug open again). That fall blocked one of the three ways in and out of the quarry, so access remained negotiable.

Less fortunate was a party of quarrymen in the Huntershill sandstone quarry near Bishopbriggs, to the north of Glasgow, worked by Thomas Gibb & Son Ltd. On 13 September 1910 a bed of Coal Measures sandstone was being quarried underground, when a slab of stone fell from the ceiling and caused the deaths of five men and injured a sixth.

Answers

The history of Winsford Salt Mine

Graham Orme

A JCM Operator advancing the mining machine to start the next cutting operation.
The rotating cutting drum and gathering arms at the base of the JCM for the mined rock can be seen

Introduction

My knowledge of the Winsford Salt Mine (formerly Meadow Bank Mine) in Cheshire was gained during my fifty years employment there, starting as an apprentice electrician in 1969 until my retirement in 2018 as a member of the Environmental, Health, Safety and Training department.

During that time working underground and at the surface gave me a unique opportunity to discover and understand the history and importance of the site. Although I am not a qualified geologist, in my later role in the EHS department it was vitally important to understand the fundamental mining operations. Working alongside earlier generations of miners gave me an insight of the history of the Winsford Salt Mine, which has driven me to research the mine's history and relevance to Winsford.

The formation of salt deposits

The history of the salt mine in Winsford starts a long time before the first shafts were sunk in 1844. The story starts

with the formation of the salt beds during the Triassic and Permian periods some 220 million years ago, when the continents as we now know them were joined as one land mass, known as Pangaea.

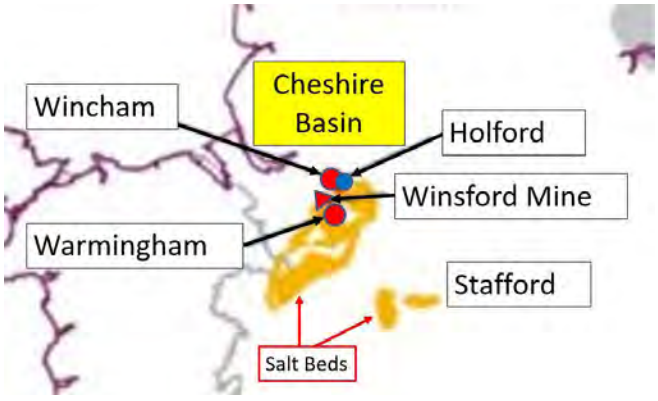
At the time the land mass split, and the continents were formed, the future United Kingdom was still attached to Ireland and Europe. This land mass had a series of inland seas that were regularly topped up by the surrounding oceans.

The next stage was the formation of the salt beds, brought about by an evaporation process that took millions of years to form those beds beneath the land. Uniquely the salt beds have acquired an occasional pink 'tinge' due to the large amount of sand that was incorporated through winds from the deserts in the east. During mining operations at Winsford we saw many examples of this pink-tinged rock salt which gained a local term as 'beef rock'.

In the diagram, the main Triassic rock salt bed that the Winsford Mine is situated on starts in Northern Ireland at Carrickfergus, disappears under the Irish Sea, reappears in central England and disappears under the North Sea, appearing in beds across Europe.

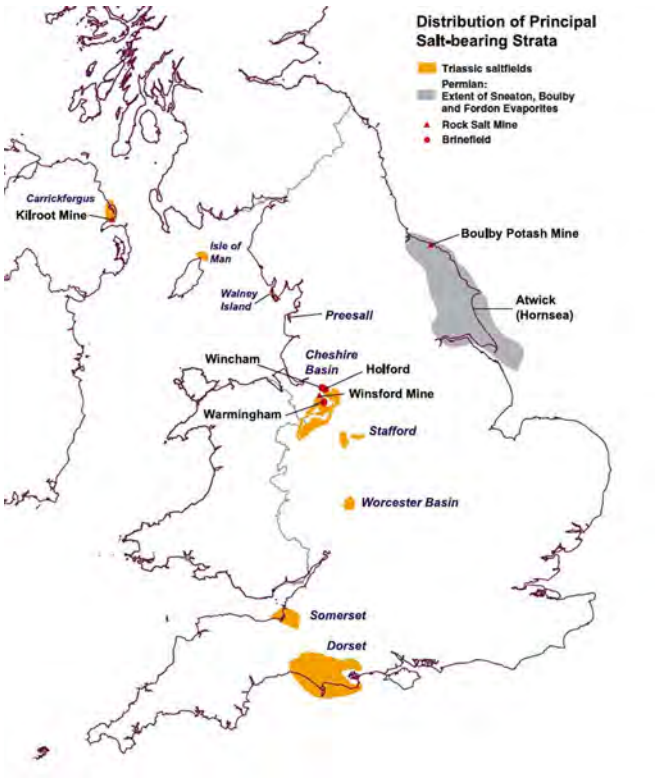
The operation at the Boulby Mine, North Yorkshire, situated on the Permian bed, required mining through the salt beds to extract potash. Consequently, the rock salt is stored and sold as a secondary product.

The main two Triassic salt beds or seams that are part of the Cheshire Basin fall into two distinct groups: the up to 300 metres thick Wilkesley (Upper Saliferous Beds), and up to 295m thick Northwich (Upper Saliferous Beds). These beds are **halite**, a Greek term meaning salt. The purity of the Wilkesley bed is approximately ninety to ninety five percent halite.



Separately the remaining seams consist of a mixture of Keuper marl (multiple layers of mudstone and siltstone of Triassic age) and **rock salt**. This is usually amber or brown in colour when mined (see picture).

Over time, water penetrated the exposed marl in the salt beds, creating a 'wet rock head' by dissolving the salt. Consequently, wild brine springs were formed on the surface in many areas, for example in Marbury, Barnton, Nantwich, Northwich and Middlewich. Historically these were used as the source of brine for **white salt** production from ancient times up to the early twentieth century.



Uses for salt

Salt is utilised in various ways: around thirty percent comes in solid form as **rock salt**, primarily used for road de-icing. A small amount is used in sugar beet and animal fertilisers. The rest is used in the form of **brine** in inorganic chemical industry production as a basic but essential feedstock.

The salt in brine is used to manufacture chlorine, soda ash and in ammonia soda ash through an electrochemical process. Additionally, for the production of **white salt**, for table use, food processing, producing animal feeds and tanning. With the proximity of the salt beds and the ability to produce brine, it is perfectly obvious why Cheshire, through early days to the formation of Imperial Chemical Industries in 1926, became an important area for the economy of the United Kingdom.

The history of salt production in Cheshire

Salt has been an important and valuable commodity (people who were paid in salt received a ***salary***) for thousands of years and was originally produced from

around the years 300 to 1150 AD on the coast by allowing sea water in small pools to evaporate, leaving **sea salt**. As demand grew the sea water was heated in open 'pans' to speed up evaporation.

The Romans established salt towns, which can be seen by some of their names: in Nantwich, Middlewich and Northwich, *wych* describes a brine town. Over many years salt production increased and around 1670 it became a booming industry. As demand grew for the natural brine this led to the establishing of wells and pits to gain access to the deeper brine streams from the **wet rock head**.

However, the uncontrolled overuse of these wild brine springs and mechanical pumping over many years caused subsidence in some areas. This led to the banning of brine pumping and the development of 'solution mining'. Examples of solution mining can be seen at the nearby Holford Brine fields in Cheshire. From this discovery shafts were sunk to enable the beginning of numerous salt mining operations around Winsford.

The use for rock salt at that time was two-fold: for cattle licks which gave additional minerals to animals; and to strengthen the brine in the evaporation process in large salt pans that produced white salt for commercial and home use.

Winsford became a large producer of salt. Family owned factory business based on the open pan evaporation process around the lower area of the town. (see diagram)

Overcapacity and chaos through the late nineteenth century led to profits dwindling for the owners and to sixty-six of them forming the Salt Union which attempted to stabilise the market.

Although Winsford, Middlewich and Northwich are historically the base of solution mining in Cheshire, part of the Winsford Mines history was the production of **white salt** through the vacuum process.

The brine was pumped to the mine from the Holford Brine Fields, via the Lostock Works where it was purified, and then on to the Winsford Vacuum Plant where it was processed primarily into **Dendritic Salt,** a high-purity food-grade product sold mainly to Nigeria, and **Pure Dried Vacuum** (an extremely versatile product with wide applications). The demise of this part of salt production caused the demolition of the Vacuum Plant around 1989 after the loss of the Nigerian market, due in part to the Biafran War.

Physical layout of the mine

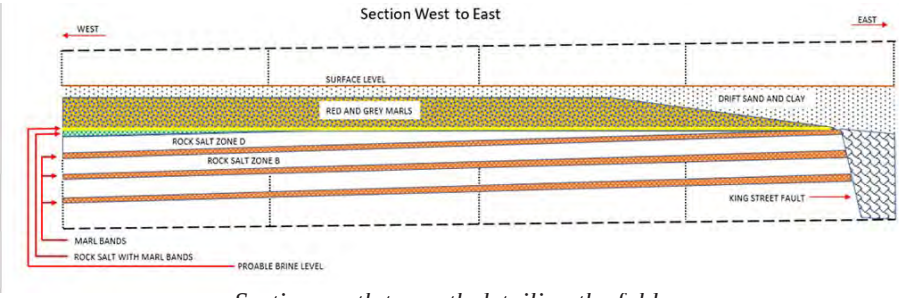
Below the surface of the Winsford mine are four primary 80ft-thick seams of **rock salt**. These seams over millions of years have been affected by immense geological pressures, and consequently have developed Monocline folds (linear with dip in the seam in one direction between horizontal layers on each side), and Fault planes (where the seam has sheared either upwards or downwards).

The folds run east to west, and the faults run north to south. The circles on the diagram show the positions of precautionary bore holes drilled to establish the position of the various layers of rock salt.

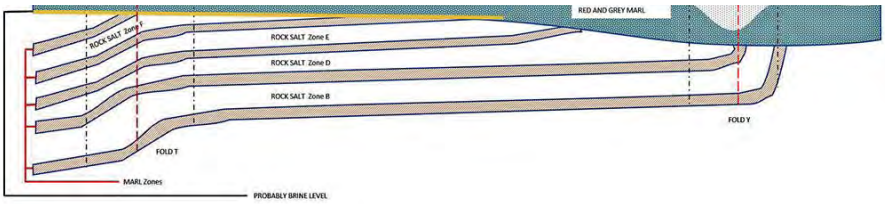
There are two workable good quality salt beds, named Zone B and Zone F. Each bed is about 25 metres thick with the better-quality salt at the lower part of the bed. Prior to Zone F being 'mined out' decisions were made to open Zone B. Consequently, two drift tunnels were driven to the lower Zone B, through a monocline fold, where through strata movement the salt bed dips, to where the current mining takes place.

The first tunnel was machine mined using a Joy Continuous Miner (JCM) while the second tunnel first section was hand-drilled and blasted but completed by the JCM. The two tunnels were started in 2012 and

Salt Union Works at Winsford. Manufacturing salt by the salt pan system



Section south to north detailing the folds



Section west to east detailing the fault which runs below King Street, a roman road

completed by linking them at the lower level two years later. To ensure adequate ventilation air is forced down one tunnel into the working and comes back up the other tunnel. This houses the drift conveyor, enabling the mined rock to exit Zone B to the crushing and screening process, and finally to no. 5 shaft for elevation to the surface.

The history of the mining operation at the Winsford Mine

Rock salt was first found in Marbury, Cheshire in 1670 when digging for coal. Mining continued in the local areas of which Northwich, Marston and Witton are just a few examples.

Herman Eugene Falk (1820–1898) was born in Danzig, Prussia, and landed in England at eighteen years of age to join his brothers in Hull. The Falk brothers were operating a timber importing business, and had a contract with engineer Robert Stephenson for the supply of railway sleepers. The ships' return trips to the Baltic transported salt.

In 1844 he sank two shafts at Meadow Bank, Winsford to access the salt beds, and became a salt merchant. The mine expanded over the years and at the time of his death he employed around four hundred men and boys in salt production and his farming interests.

In 1855 the Adelaide mine in Northwich owned by the Verdin family was opened. This added to the around sixty salt mines in the area. Unfortunately, at the height of its production in 1928, water ingress eroded the supporting pillars, causing the mine roof to collapse and flooding the mine.

In 1928 it was decided to reopen the Winsford Mine shafts that had closed in 1892 due to earlier overproduction. From that day the mine has expanded; electricity was introduced in the 1930s and the mine continued developing rapidly with increased demand for de-icing salt for the roads.

Important considerations when mining

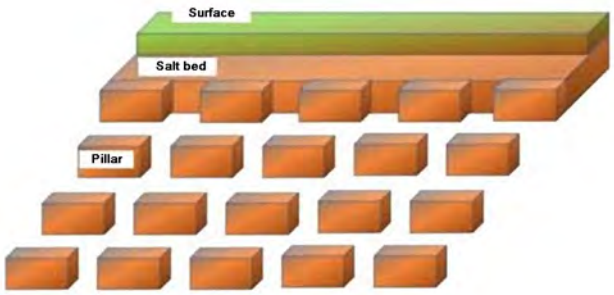
To understand the salt production history of the mine we must first remind ourselves of the core principles of mining:

- do not let the strata collapse
- ensure there is suitable and sufficient ventilation
- do not set it on fire
- do not let it flood
- and ensure it is safe when you abandon it.

Controlling the strata

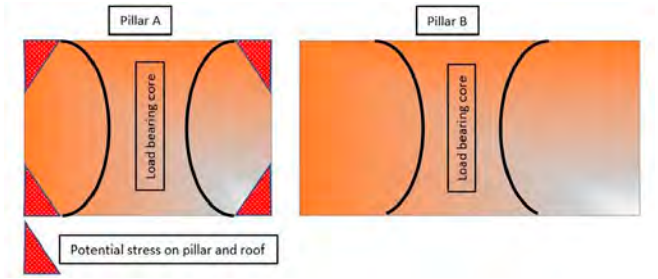
The underground stability of the mine is vitally important. Uncontrolled mining in the past in the mid-Cheshire area has caused untold damage over many years, canal banks and beds have failed and buildings, particularly in Northwich, have collapsed.

The method of mining at the Winsford mine is called 'Room and Pillar' extraction, basically a 'Checkerboard' pattern of mining (see diagram below). Headings are created going forward and cross-cuts are across those headings.



The basic principle is to extract the rock salt in a horizontal plane, leaving untouched pillars to support the mine roof. Small pillars left behind can and will cause collapse of the strata, while leaving large pillars will lead to having to mine greater areas to achieve desired

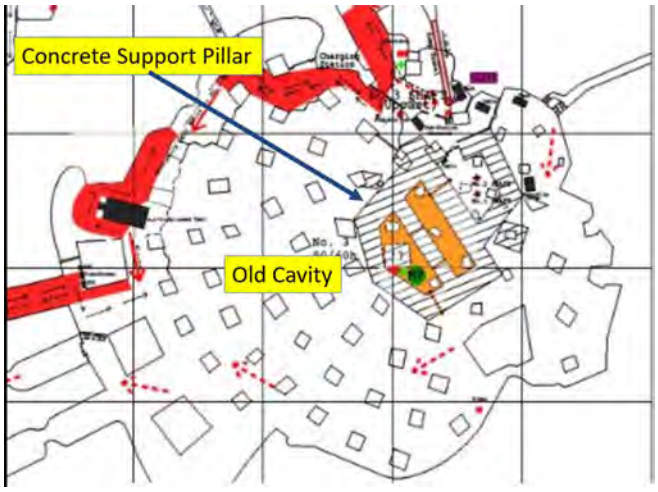
production goals. The example in the diagram shows two pillars of differing sizes.



The load-bearing centre of those pillars (above), often called the apple core, is an important consideration when studying rock mechanics and designing extraction rates. The pillar 'A' design demonstrates potential creation of undue stress points that can cause pillar spalling and ground heave.

The pillar sides buckle and fragment, the pressure at pillar floor level through upward movement of the strata, with creeping (movement over time) leading to pillar failure and collapse. Pillar 'B' design helps to overcome these issues.

Early mining at Winsford and Northwich, utilising the Room and Pillar method, was not originally effective, and the study of rock mechanics was not perhaps at the front of decision making. The extraction rate was high, leaving small pillar sizes and consequent issues. At Winsford this led to the building of a large concrete pillar, shaded in the plan below, in the early 1970s to add additional support around the areas of concern.



When the rock is mined leaving pillars, the height between mine floor and roof reduces initially and settles after time; this is termed convergence. The convergence is measured by installing measuring stations, which consist of embedding special bolts in the mine floor – see picture below – connecting a length of metal tape to the roof bolt and measuring the distance between the two at prescribed intervals.

In order to determine correct pillar sizes a few basic principles should be considered: the depth at which the mining is taking place, the strata, and the surface geography. Although the rock salt strata at the Winsford mine is stable, the deeper you mine, the more load there is on the strata below.

By regulating the pillar size and careful planning, the extraction rate at Winsford progressed in the 1950s, and depending on factors like depth, and surface geology, was between 68 and 75 percent. From 1958 onwards a rock mechanics study took place with help from the Mining Department at Newcastle University. This achieved stable planning for present and future mining.

The mine has a surveying department that is required to carry out the following: produce long-term mining plans; update current plans; carry out convergence measurements; and drill into the mine floor to check the depth between the mining operations and the bottom of the salt bed.

Historically the mine used to take core samples by drilling into the rock face to determine the quality of the salt

ahead and if there were any anomalies. Later this was replaced by using radar. Holes were drilled in the face and explosives placed. On firing the explosives, the radar is utilised to measure and chart the reflection which gives a picture of the rock ahead and identifies any issues.

Ventilation

Fresh air is vitally important to the safe and healthy operation of the mine. The original method of ventilating the mine relied on the movement of the cages in the two shafts. When one cage was descending into the mine, the other would be travelling to the surface, creating a 'piston' action and changing the air in the mine.

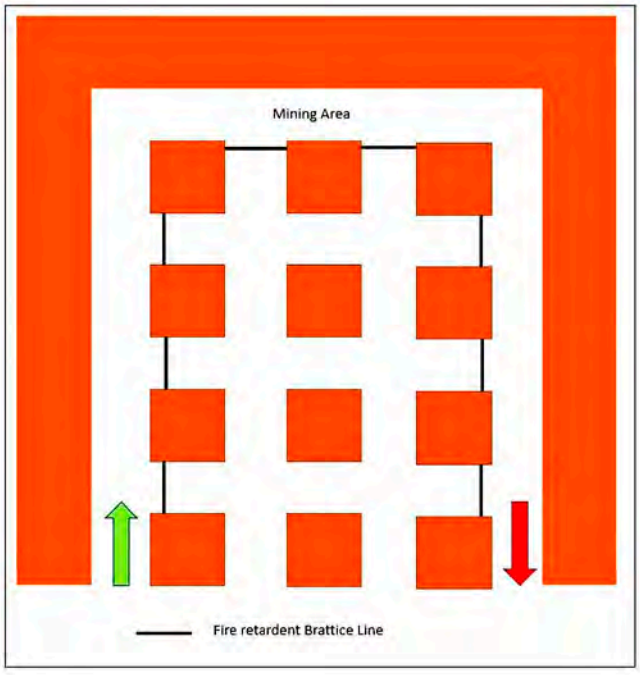
After the introduction of electricity and diesel-powered equipment in the 1930s, a more effective mine ventilation system had to be developed. Diesel fumes adding to the shot-firing fumes had to be overcome. After shot firing, oxides of nitrogen and carbon monoxide are generated. Diesel exhaust fumes contain particulate matter and nitrous oxides. Additionally, mining operations create dust that adds to the particulate matter.

Exhaust fumes are harmful to health, especially in underground locations. Subsequently, over many years the installation of mine fans and a purpose-designed ventilation circuit ensured fumes in the mine were controlled.

The first fan installed was a Sirocco one point nine metre diameter

To enable the effective use of the fresh air drawn into the mine, a system of 'bratticing' off the part of the mine where the salt had been extracted created a route for the fresh air to circuit the mine. These brattice lines are fire-retardant hessian and heavy-duty PVC 'cloths' that are hung from the mine roof to the mine floor. This creates a dedicated ventilation circuit.

Additionally, when crossing a ventilation circuit, a pair of automatic roller shutter doors were installed. The diagram below demonstrates how the fresh air flows in the direction of the green arrow ventilating the mining area and picking up any fumes or dust created by the mining operations. If the brattice line is enabled it ensures maximum use of the fresh air from the down shaft, and the stale return air in the direction of the red arrow is then directed through the mine to the up shaft.



The brattice line does not ensure a complete seal, as a reduced amount of air can enter the bratticed area, allowing inspections or maintenance work inside the area to be carried out safely. Access to these areas is strictly controlled before and after entry by the Mine Command Supervisor.

As the mine developed the original fan was moved to the bottom of no. 4 shaft, where an additional fan was installed in parallel to boost air entering the mine at approximately 135 cubic metres of fresh air per second. As the ventilation circuit grew in length, booster fans were added to increase efficiency.

Ventilating the mine with fresh air had side effects that can cause damage to the mine fabric. The temperature of the mine is a constant 14 degrees, so pulling warm air underground causes condensation to form on the pillar sides and roof. This condensation on the rock strata causes the salt to dissolve, which will ultimately lead to stability issues.

Consequently the fresh air entering the mine is directed into de-watering tunnels which is a specific area where the moisture in the air stabilises with the mine temperature and any water from the condensation is collected and pumped out of the mine. This area is inspected on a regular basis.

From the de-watering tunnels the fresh air then travels around the mine through the ventilation circuit, diluting any fumes and dust, finally exiting the mine at no. 5 shaft, the upcast shaft.

In other mines there are constant issues with methane and other gases. Fortunately, the salt beds at Winsford do not suffer from methane leakage; nevertheless constant monitoring is carried out and when it is necessary to drill down into the mine floor for the bolting down of equipment or determining the depth of the salt bed, adequate precautions are taken.

Fire Precautions

Although Winsford is not classed as a gaseous mine, suitable and sufficient precautions are in place to ensure the mine complies with appropriate regulations and is a safe place to work. The consequences of an underground fire cannot be underestimated. Depending on the source of the fire will determine the harmful gases produced.

The mitigation of underground fires starts with having a Fire Risk Assessment Plan which is reviewed on a regular basis. The main areas of concern are vehicle fires, and documents and waste storage areas. The latter two will be covered later.

The mine has a fleet of personnel transport and maintenance vehicles, plus large front-end loader shovels, all of which require fuel. All are diesel-powered as petrol has a lower flashpoint than diesel. Each vehicle, from light transport up to the large loading shovels, is fitted with fire suppression systems. The smaller vehicles are fitted with under-bonnet fire suppression systems (pictured).

Larger vehicles have dedicated systems fitted appropriate to their size. Each vehicle is fitted with a portable fire extinguisher. Diesel fuel is gravity-fed into and through the mine from surface storage tanks to diesel refuelling stations, all suitably protected.

Precautions against inrushes (floods)

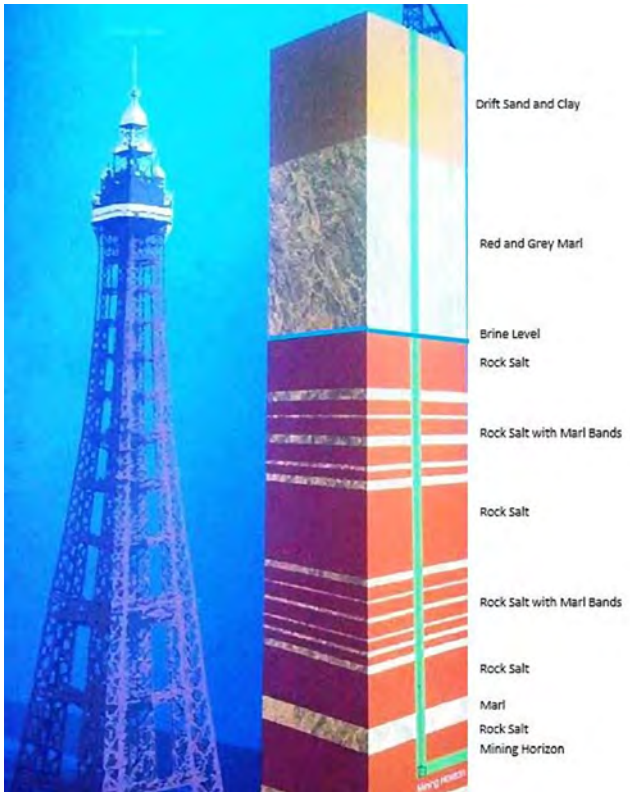
The diagram shows a section of the mine plan with more detail of some of the precautionary boreholes, shown as red circles. The boreholes are drilled from the surface into the strata to determine the level of the salt seams, which pass through the wet rock head. These boreholes are sealed once the levels are determined.

Unfortunately, in November 1968 a borehole was breached during undercutting operations, and the mine started to flood with brine from the wet rock above. It is believed that the borehole had not been plugged effectively after drilling.

To ensure the mine was not lost, ICI employed a company to replug the hole. In addition, large pumps were deployed underground, connected to a series of pipes so the brine was pumped to the surface.

Sinking the mine shafts

Excavating a vertical shaft is known as shaft sinking. To get to the mining horizon, shaft sinking was required. In the diagram you can visualise the depth of the mining horizon compared to the height of the Blackpool Tower.



Nos 1 and 2 shafts

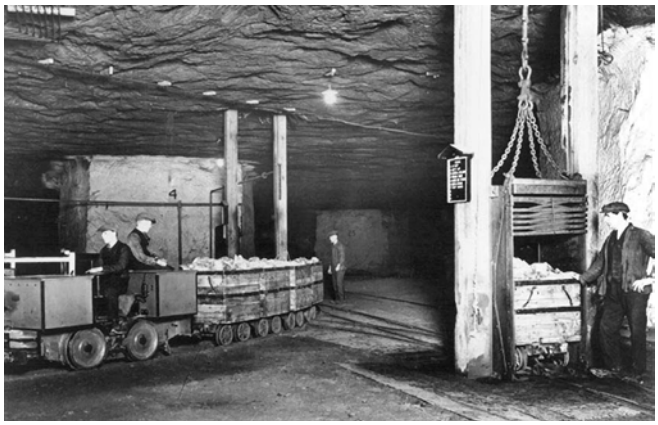
As mentioned previously the first two shafts were sunk at the Meadow Bank Mine, Winsford, in 1844, and named nos 1 and 2 shafts.

The two shafts were approximately five feet square and were lined with timber and puddle clay. Originally access and egress for the mine was achieved in large buckets, which were used to transport personnel, materials and the mined rock salt to the surface. (See photo below)

The buckets were replaced by small purpose-built cages that ran along wooden timbers running through the shafts. The cages were still in operation in the early 1970s. I remember fondly travelling through those shafts, one person in each corner of the cage and one in the middle. The shafts were finally sealed in around 1978.

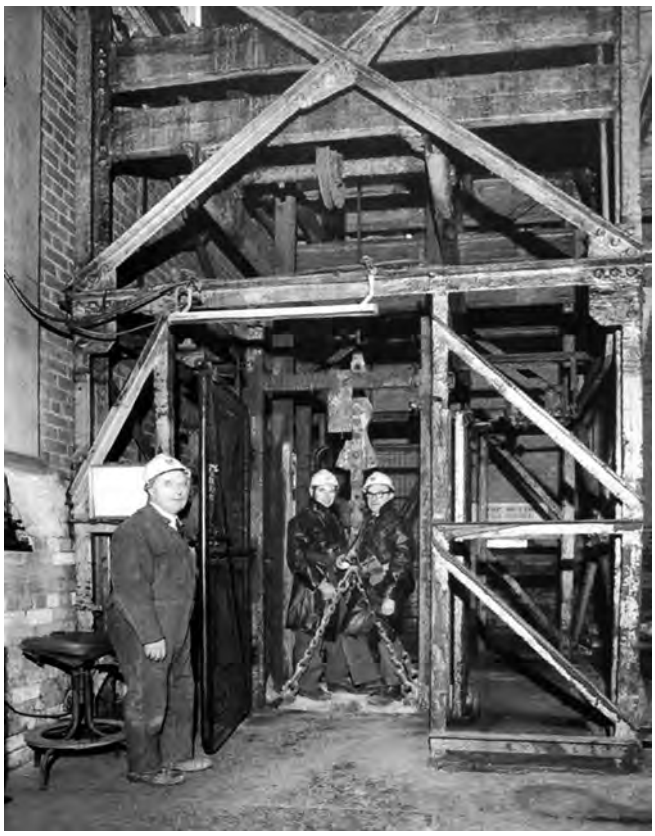
At a depth of around two hundred feet the first mine was opened with limited production; later the shafts were sunk further to a depth of around five hundred feet in a bed of better-quality rock salt. I recall in my youth exploring middle mine to inspect the drainage pumps.

After the introduction of electricity in the early 1930s the method of getting the rock to the bottom of the two shafts was much improved with the introduction of a small battery-powered locomotive, pulling purpose-built wagons. The wagons were individually placed in either of the shafts and elevated to the surface. On arrival at the surface the wagons were placed in a mechanical wheel and tipped up, allowing the rock to be emptied. The empty wagon was then sent back underground



The two shafts stayed in operation for man winding operations into the beginning of the 1970s. As with all shafts daily inspections were carried out to ensure continued safe operations. Men would travel through both shafts riding on top of the cage. The use of a whistle ensured constant communication with the 'Banksman' at the surface.

Nowadays one of the two shafts is completely sealed from top to bottom. The other is partially sealed, allowing access for inspection by lowering a camera to check for leakage between the wet rock head and salt layers.



No. 3 shaft

No.3 shaft was sunk in 1963, to a depth of 168 metres. The actual access to the workings is at a depth of 152 metres. The shaft was lined with bricks originally and later relined with concrete; it has a diameter of three metres. The shaft replaced nos 1 and 2 Shafts as the main production shaft.

Installed within the shaft were two cages, balanced within the shaft; whilst one was at surface level the other was at mine level. Each cage was of a double-deck design: top deck for man winding, the bottom deck for the mined rock salt. This was for a period the main production shaft at the mine until Shaft 5 was sunk and balanced cages installed.

Eventually in 1986, when no. 5 shaft became the main production shaft, no.3 shaft was modernised, cages removed, and a purpose-built passenger lift installed (photo above). Trained and competent persons are allowed a more efficient personnel access into the mine after suitable training.

No. 4 shaft

In 1963, near to the small town of Moulton, approximately one mile from the mine, no. 4 shaft was sunk to a depth of 189 metres to the sump bottom, with a mine access level of 183 metres. This shaft is concrete-lined and just under five metres in diameter. Originally installed were two balanced cages (when one is pulled up the shaft, the other enters the mine). The cages were used to transport personnel and limited equipment / materials.

Larger pieces were 'underslung' beneath the cage. Large mining equipment was dismantled on the surface then strapped under the cage, transported underground and taken to a part of the mine to be rebuilt.

Later the two cages were removed and replaced by a single cage, 7-metres high, 4 metres deep and 2.5 metres wide, with a personnel carrier positioned on top. This enabled larger loading shovels and eventually the Continuous Mining machines (later in the development of more efficient mining processes) to be taken apart on the surface and rebuilt underground.

Photo Nick Catford

Gantry cranes were installed (photo above) after this fundamental change at the top and the bottom of the shaft to enable efficient loading and unloading of materials and equipment into the cage.

Shaft 4 is classed as a 'down cast shaft' referring to the mine ventilation system. Additionally, installed at the shaft bottom are two large fans that pull the air down the shaft to ventilate the mine. Near the top of Shaft 4 is a small, angled access shaft that allows the air being pulled into the mine to by-pass the cage if it is parked at the surface.

No. 5 shaft

The main shaft for elevating finished rock salt is no. 5. Positioned approximately 100 metres from no. 3 shaft, it was completed in 1973 and was the last one to be sunk. This concrete-lined 4.88-metre diameter shaft has an overall depth of 164 metres.

The shaft is classed as an 'upcast shaft' as part of the mine ventilation system. As with no. 4 shaft there is a small, angled access shaft at the surface to allow the mine air to freely vent when either of the two cages is parked at surface level.

The winding engine drum has 'cage over skip' combination in balance. The rock is loaded into either the riverside or roadside skip automatically at the mine level of 155 metres. The top cage is for man winding and the skip below is for rock elevation, with the skip portions each having a capacity of nine tonnes and being of the bottom-dump type.

The rock winding process is completely automatic, although the winder man can operate it manually when required for maintenance, personnel riding, or shaft inspections. Recently the original winding apparatus was replaced by a modern unit, effectively increasing the efficiency of the rock elevation.

Approximately two years ago the man-winding operation became 'self-sufficient'. Trained and competent persons could summon the personnel portion of the skip to man deck, enter the cage and either access or egress the mine. At one stage all the shafts, picture below, were in use.

Originally in 1966 the mine had its own special regulations for the winding operations, as did other mines in the UK. These were all superseded by the Mines (Shafts and Winding) regulations during 1993.

At one stage in the 70s, all the shafts, No. 1,2,3 and 5 were in use

Changes in the mining method of production

From 1844 to 1892 the first mining was carried out with the use of hand tools and early explosives like black powder, a Chinese invention consisting of sulphur, saltpetre (potassium nitrate) and charcoal. Simple yet effective, with a production of around one million tonnes.

This mining took place around the bottom of nos 1 and 2 shafts. Once the rock was broken into manageable sizes it was transported in wheeled barrels on basic rail track to the original shafts and elevated to the surface. Illumination was by tallow candles. Evidence of this can still be found in the old workings.

After the introduction of electricity, more efficient mechanical methods were introduced to 'win' the rock. The introduction of 'undercutters' and 'roof cutters' – rotating cutting blades to slice into the rock face – enabled either a flat floor or a flat roof.

These machines were used up to the time of the introduction of the Joy Continuous Miner(s). The first under- and overcutters at the mine were utilised to cut a slot into the rock face, slightly above and angled to

One of the first undercutters

Overcutter in action

Last undercutter used

This overcutter is basically an undercutter on a purpose-built frame. Designed by ICI.

the mine floor, or cutting a slot into the rock face, again angled, but to the mine roof. After shot firing a flat roof or floor was left.

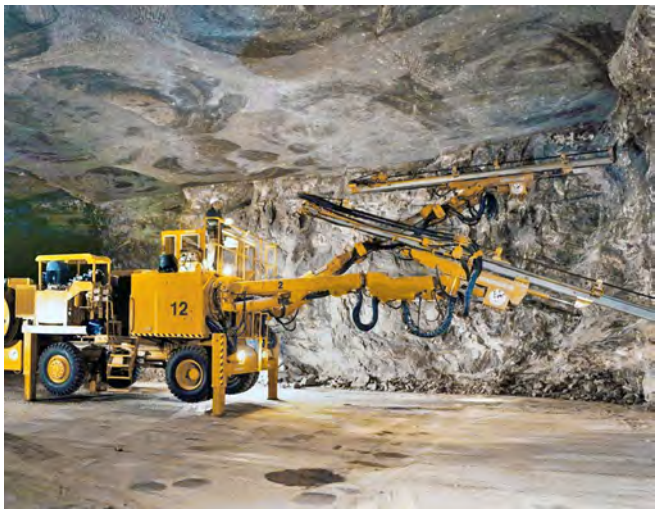
A 'bench' was then created where 'down hole' drilling took place. This was achieved by drilling holes from the bench down into the salt, placing explosives in the holes and shot firing, blasting the bottom. There are areas in the mine where evidence of this practice can still be seen.

Drilling the face prior to shot firing

Since the introduction of electricity the use of electrically powered drilling equipment has increased production

dramatically. Over the years even more sophisticated drilling equipment has been introduced. As can be seen, the Taylor Hurd drill, below left, and Secoma drill, below right, allowed the operator to position the drill rods to the required drill pattern that is designed to extract the rock after the holes are charged and shot fired. The holes are not drilled parallel to the mine floor, but at certain points angled so that when the shot is fired the rock comes down in a manageable way for loading out.

The PTT drill (below) was an extremely sophisticated, computer-controlled drilling platform. It had a twin boom set up, diesel-powered to get to the face and then electrically powered by a 'trailer cable' connected to the face electrical supply. The face drilling pattern is programmed into the computer. The operator then manoeuvres the PTT to the face, and lowers the stability jacks to the floor.



The operator positions the left-hand boom to the top of the left-hand side of the face, enters that reference point into the computer, then lowers the boom to the bottom left-hand face and enters that point into the computer. He repeats this process on the right-hand boom at the right-hand side of the face. Now the computer has a true picture of the face profile, the operator is ready to start the drilling operation. The booms automatically travel to each required hole location, position approximately a foot from the face, ensure the correct drilling angle, and wait for the operator to allow that individual hole to be drilled. After the hole is drilled the booms move to the next required drilling location and the process is repeated.

Scaling after shot firing

The use of explosives to 'win' the rock has two immediate potential hazards: the fumes from the explosives and loose rock in the roof and on the pillar sides. The fumes are diluted by the mine ventilation system, however before personnel are allowed into the area, air-quality readings are taken.

Shot firing around eighty shot holes loosens rock on the mine roof and pillar sides. These pieces can be substantial and if they fall away can cause major injuries and equipment damage. Once the fumes from the shot firing

are diluted a skilled team of 'hand scalers' approach the face and using long hickory poles with a metal 'beak' at one end look for the potential loose rock in the roof and pillar sides and remove them.

The addition of mechanical scaling equipment enhanced the safety of the roof and pillar sides. The electrically powered Gradall Scaler, pictured below, was one of the first examples.

The operator sat in a safety cab to drive the Gradall to the required location. He then controlled the lifting and manoeuvring of the scaling arm, forcing the beak at the end of the arm to powerfully remove loose rock by scraping or prising the roof or the pillar sides.

A later method of mechanically scaling the mine roof and pillar sides was carried out by the introduction of a diesel-powered scaling machine. This comprised a boom with picks attached to a rotating cutter head. The boom was attached to a Caterpillar 225 B tracked machine. As can be seen in the picture on page 64, this is an extremely efficient method of mechanically scaling the roof and pillar sides.

Although there is now no requirement to produce rock by shot firing methods due to the introduction of Continuous Mining machinery, the Scaler is used to make safe parts of the mine that will be used for storage purposes, for example room building for the Deep Store business.

Crushing and screening the final product.

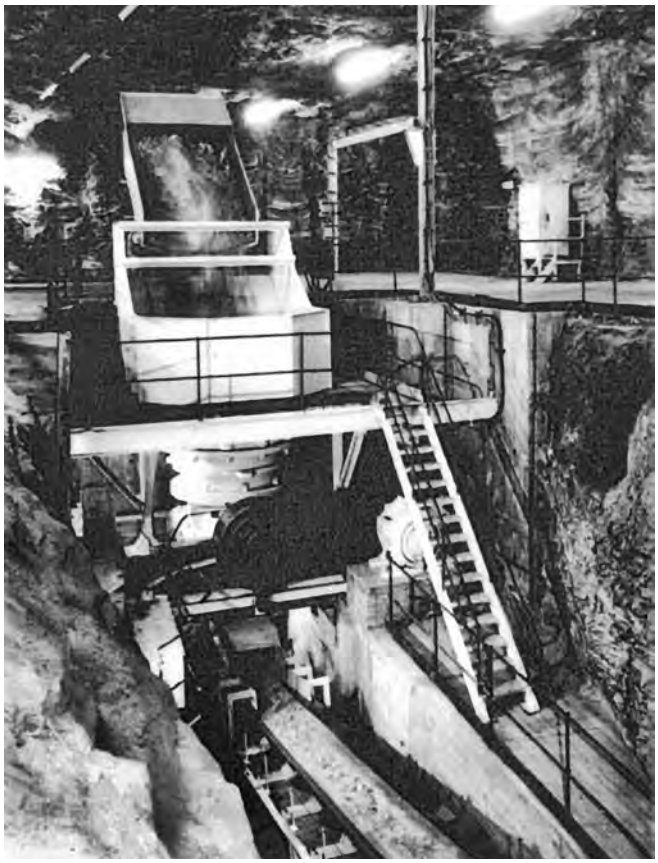
Crushing, screening and elevating rock salt has changed over the years, from simply blasting the rock and breaking it manually to the introduction of the GEC underground crushing and screening plant that has the facility to reduce the size to either 6 or 10mm, the finished product specification.

At one stage at no. 3 shaft a trial took place to 'blow' the partially crushed rock salt to the surface. This unfortunately had limited success.

As the distance from the faceline to no.3 shaft increased, local 'Feeder Breaker' crushers, connected into the conveyor system, were positioned close to the production face to primarily crush the blasted rock pieces. These feeder breakers were advanced, and conveyors extended on a regular basis to keep the distance from the production face as short as possible. Additionally, LHDs (Load, Haul and Dump) machines were introduced into the mine, see picture above.

The LHDs would pick up the recently blasted rock and transport it to the nearby crushers. These machines replaced the Foden dumpers and loading shovels. The LHDs were eventually replaced by a Caterpillar 990, (below) which was more powerful and had a larger capacity bucket.

The mine now has a Komatsu WA 800 loading shovel with a bucket capacity of 20 tonnes. Until the new underground crushing and screen plant was operational in the mine in the 1970s, mined rock was transported to a 'Pegson' Crusher situated around the bottom of no.3 shaft by a Foden Dumper. The dumper truck reversed up to the crusher and tipped its load into the crusher throat. Once crushed it was elevated through no.3 shaft and conveyed to the surface crushing and screen plant.



Pegson crusher

Surface crushing and screen plant

The main advantage of underground crushing and screening was the constant temperature and low humidity in the mine. Surface crushing and screening did not have this. Additionally, the underground processing was designed to take a greater throughput of rock as demand grew for finished product.

The rock arrives at the GEC crushing and screening plant and is elevated and run through a roll crusher that reduces the size down to approximately 25mm. The rock is then put through the first screen (primary) fitted with either 6 or 10mm screen cloths. This screen is on a slope and vibrated, allowing the rock to pass through to the next part of the plant. Any rock that is at the required size passes through the screen cloths and short circuits the plant and out to no.5 shaft for elevating to the surface.

Oversized rock that has continued through the primary screen is elevated by conveyor and dropped into the final crusher which has a double set of 80-inch wide rollers, which crush the rock down to a finished product size of either 6 or 10 mm, depending on what the roll gap in the crusher is set to.

The rock then passes to a secondary vibrating screen, fitted with appropriately sized screen cloths.

Any rock that is at the required size passes through the screen cloths and out to no. 5 shaft for elevating to the surface. Oversized rock is recirculated back into the system and back to the main crusher.

Introduction of JOY Continuous Miners

Through the years management has consistently sought to introduce more efficient methods of rock salt production; consequently it was decided to trial mining machines. Around 1988 the first introduced was a Dosco LH1300 road heading machine which was basically a tracked machine with a forward-facing boom and a rotating cutting head. These were operated in coal mines. At the time it was used to develop the Whatcroft area of the mine by driving a tunnel through into this area.

Once the Whatcroft area was opened the mine reverted to the usual method of drilling and blasting. As the Whatcroft area was in a higher bed, a large shaft was cut between the Whatcroft and the lower bed, where processed rock was delivered down to the lower bed and onto the existing conveyor system.

When this operation was completed a Westfallia WAV 170 road header mining machine was trialled in another part of the mine. Although both these machines were relatively small compared to what was required to meet production capacity, it was decided the introduction of mining machines was the way forward.

This was close to the time ICI was divesting the mine, around 1990, consequently the focus was to carry on mining in the traditional method. The mine was then purchased by the American Harris Company, which also acquired salt mines in Canada and the USA. Compass Minerals, the current owner of the mine since 2003, reviewed the idea of continuous mining in the UK.

In January 2002, after considering many manufacturers' mining machines, a Joy Continuous Mining Machine (JCM) was purchased. Once fully operational the JCM replaced the original method of mining, drilling and blasting. Due to the successful implementation of this JCM a second was purchased in 2011 and a third in 2014.

There is a history of JOY equipment at the mine, going as far back as to the late 1950s.

One of the early methods of mechanising the mining operations using JOY mining equipment

The JCM is an electrically powered (1,005 kilowatts) single drumhead tracked mining machine weighing 130 tonnes. Fitted to the rotating cutting drum are tungsten-steel cutting picks which cut into the rock face as the

machine head moves up and down. The cut rock falls onto the front of the JCM pan, and gathering arms move the rock through the middle of the JCM on a chain conveyor.

At the other end of the JCM the rock is loaded onto the Bridge Belt Conveyor, which acts as a connection to the Walking Tail End, which in turn is connected to the faceline conveying system, allowing the cut rock to travel to the crushing and screening plant.

The Bridge Belt Conveyor moves along the WTE following the JCM until the maximum design distance, where the cutting operation is stopped and the WTE literally 'walks' forward, the Bridge Belt Conveyor moving back to the original end of the Walking Tail End, minimising the distance to the JCM, and the cutting operation resumes. After the WTE moves closer to the JCM, additional belting is installed. The Bridge Belt Conveyor can move to the left and right as the JCM cuts across the face.

JOY loader

Bench cutting

The JCM cuts to the original room and pillar design, however to a maximum height of 4.6m. Therefore the JCM achieves the required 8 to 9m height by creating a ramp to the desired cutting height, along a distance of approximately 1km, where the JCM and associated equipment is 'pulled' back and the ramp is removed and the lower tunnel cut, enabling the full tunnel height to be reached.

As the tunnel is being cut, at both top and lower level, the JCM creates cross-cuts to the left and right at right angles, creating the start of a mine pillar (above). Once the tunnel is fully completed to its maximum height, the JCM and associated equipment is pulled back and a parallel tunnel is cut, following the same sequence. When the JCM cuts into the cross-cuts, it meets up with the previously partially cut cross-cuts, creating a mine pillar. To ensure the tunnels are correctly aligned and comply to the mine cutting plan the surveyors install a set of guidance lasers (below).

Cutting into drift

In 2012 the mine started to drive into two access tunnels (drifts) into an area called lower South Bostock, to the lower bed of salt. The original Zone F workings had become 'mined out', so consequently access was required into Zone B, through the fold. The first tunnel was driven by a JCM, the second tunnel was started by the drill and blast method, then completed by JCM. The two tunnels were completed in 2014 where they met at the lower level.

One of the drift tunnels is a service tunnel that takes the fresh air down into Lower South Bostock. The other tunnel contains the conveyor that takes the mined rock from Lower South Bostock to the stockpile at the top of the drift.

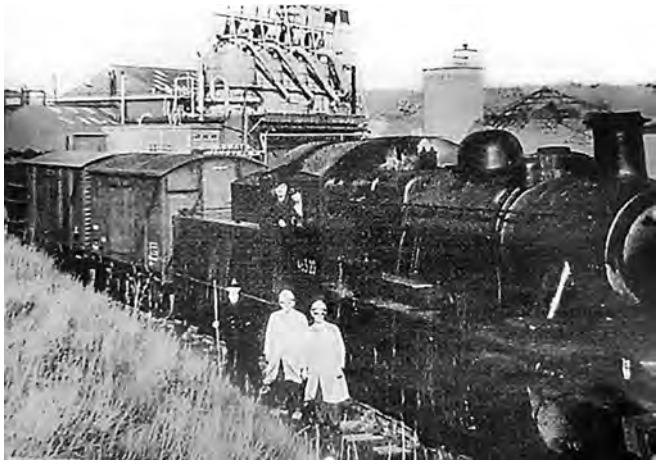
After the rock has been cut from the face with the JCM it is sent to the first primary crusher by conveyor which is located at the bottom of the drift tunnel. The crusher has a single set of parallel 60-inch rollers separated by

approximately a 100 mm gap. The rock travels to the top of the drift by conveyor and via a stockpile to a second roll crusher which is set to a gap of approximately 50mm. From the stockpile the rock is conveyed to the crushing and screening plant.

The importance of the Cheshire Lines railway and the river Weaver

In the 1720s, the River Weaver became a key route for salt transport, providing access to the River Mersey and Liverpool, with the cattle licks being exported as far as Australia and New Zealand.

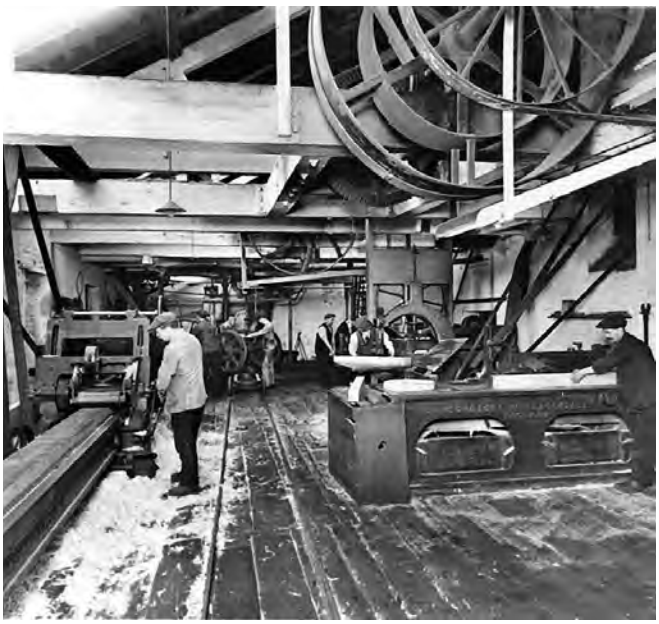
The Cheshire Lines Railway and the River Weaver had an important part to play throughout the history of salt production. Winsford uniquely had three stations, two connected to the Cheshire Lines.



This picture demonstrates the original rail and river links to the mine

The steam locomotive was coupled to either white or rock salt finished product wagons and joined the Cheshire Lines Network to deliver to customers. The conveyor on the left delivers the finished product into barges on the River Weaver.

Due to the importance of the railway and the wagons used to transport the salt, dedicated workshops were established to carry out regular maintenance.



Alternative mine use

As the mining operations progress there remain vast empty and unused spaces. The main use for the finished rock salt product is for the de-icing business, to keep the roads safe in winter months. However, the mine cannot just rely on the weather, which can swing from extreme to mild winters. Thus a joint venture was set up to look at alternative mine uses.

Document storage

The first alternative use to be implemented was to store documents safely underground. DeepStore: Document and Records Management Services was established in 1998. The first documents to be stored were in a set of filing cabinets and over many years the business expanded.

Due to the mine's security and constant humidity, DeepStore has developed a relationship with important customers who use the facilities, for example the National Records Office, Police and Criminal Services and local hospitals. Individual rooms are built, with racking installed and walls that are fire retardant. Each room has a sophisticated fire detection system that is monitored both underground and on the surface. See images at: www.deepstore.com

Waste storage

With the increase in costs for waste going to landfill, a project was implemented to look at storing hazardous waste in the mine. A joint venture was started and after regulatory permission was granted the mine started storing waste underground in 2005.

A location was identified in a remote part of the mine, and designated rooms built specifically for this purpose. The waste arrives at no. 4 shaft and after inspection on the surface is transferred underground in purpose-built containers and taken to a dedicated storage room. Each room contains one type of waste and once a room is filled it is sealed.

Acknowledgements

Compass Minerals, previously ICI
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Bob Curzon, retired miner, and local historian
Paul Hurley, local historian

Footnote

The history of this document comes from a contact I made with Nick Catford who runs a website dedicated to disused railway stations and their history. I was researching the history and closure of our local Middlewich Station, representing the Town Council, to try and get the station reopened.

Whilst making contact I became aware of Nick's involvement with Subterranea Britannica, who had visited the mine in the 1990s. A small world opened up and with the sharing of the Middlewich Station history, at Nick's request I compiled this personal history of the Winsford Salt Mine.

In August 1997 an underground visit to Winsford mine was organised by Sub Brit founder Sylvia Beamon. Nine Sub Brit members arrived at the visitors centre where they were given a safety induction and kitted out with our safety gear before being transported into the mine in the passenger lift in no. 4 shaft. They then travelled through the mine on a purpose-built personnel vehicle.

At various locations they were allowed out, under supervision, to view and photograph various processes and mining equipment.

Redhill, Reigate sand, and World War II

Paul W. SOWAN

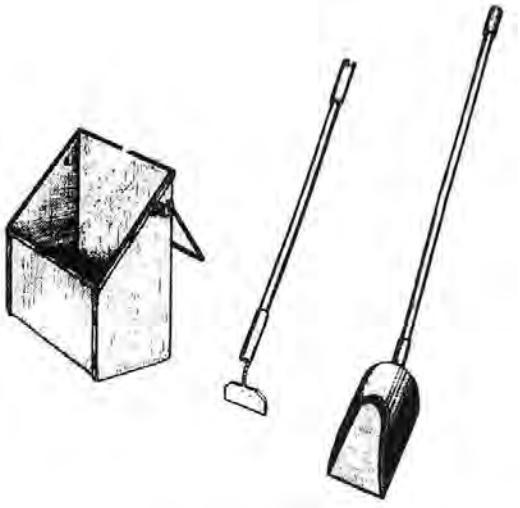
Redhill and Reigate, east Surrey, are surrounded by numerous sand-pits, open to the sky, and in at least one instance still actively worked. And in and around Reigate there are five or six relatively large industrial-scale sand-mines, as well as a number of smaller burrowings which may have been craft-scale sand mines-cum-cellars.

Available evidence, primarily 19th and early 20th century sources, suggests the major uses for this sand (from the Folkestone Beds of the Lower Greensand) included glass-making (in London) and sand-lime brick manufacture (at Holmethorpe, between Redhill and Merstham). A number of the sand mines in Reigate are, also, known to have had secondary uses, including beer and wine storage, an underground rifle range, World War I materials or equipment storage, World War II air-raid shelters and a reporting centre. A further insight into World War II in relation to Redhill and Reigate (two parts of the Reigate and Banstead District Council area) is provided by a Ministry of Home Security leaflet *'Air raids: what you must know, what you must do'* published in 1940.

Shovelling Sand on the Bomb.

This provides guidance on how to deal with, *inter alia*, incendiary bombs which contained the highly flammable material white phosphorus, and features a device called the 'Redhill container', the use of which is illustrated. This was simply a sheet metal container taking the form of an obliquely truncated cuboid, and was to contain sand for use in extinguishing incendiary bombs. From the illustrations, the box was of the order of six by ten inches on plan, and from six to ten or twelve inches high. Accompanying the box were a long-handled scoop and hoe (white phosphorus is an excessively unpleasant and toxic material which even the warmth of a human hand could ignite). On discovering an incendiary bomb, one was advised to use the scoop and hoe to take sand from the container and cover the bomb with it. Interestingly, no advice appears to be given on what to do next! Disposing of a small heap of sand containing as yet unburned phosphorus would call for some care, as the flammable material would almost certainly re-ignite if again exposed to the air. It is treated with all due respect by chemistry teachers!

The Bomb Almost Completely Controlled by Sand.



The Redhill Container. The Long-handled Scoop and Hoe. These are joined together for shovelling sand on the bomb

Courtauld Factory Shelters, Essex – Conservation Progress Report

Emergency escape ladder in one of the shelters. Photo Chris Rayner

Halstead 21st Century Group has a new website www.halstead21stcentury.org.uk A number of Sub Brit members have already contacted the group about the website and suggested improvements that could be made. The group would be really interested to hear more views of SubBrit members.

Halstead is home to a group of 16 WWII air-raid shelters (15 of which are semi-sunken), and working to save them is their most challenging project, although the website is about many types of local heritage. The following article is reproduced from the website. It was written by Judith Slater, Halstead 21st Century Group's first chairperson, in 2013.

Sheltering from the Bombs

What Muriel Constable, and Barbara Root, resident at No. 2 Factory Terrace as a teenager, have in common are their memories of using the Courtauld-built air-raid shelters during WWII and which are still behind Factory Terrace and Vicarage Meadow.

Barbara Root cannot remember the 16 or so shelters being built. She says: 'I believe they were in place two years before the outbreak of World War II, the first in Halstead, in anticipation of the conflict.' She continues:

Barbara Root by one of the shelters during the war

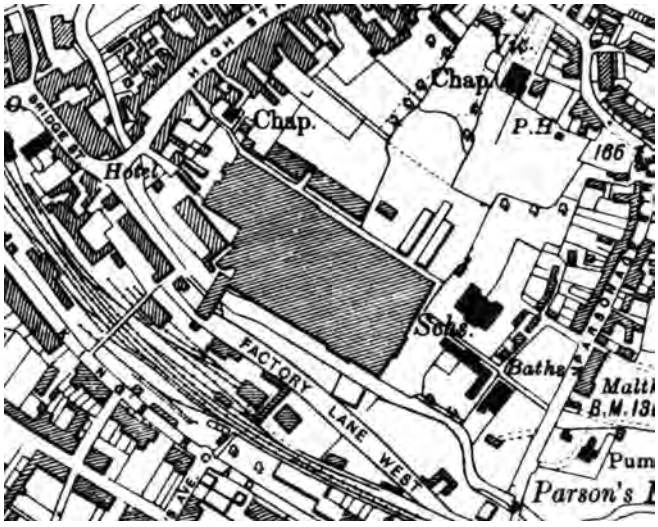
'I do recall large wooden doors opening outwards to reveal steps and a blast-proof door below.' Each shelter had wooden slatted bench seats on both sides and even separate toilets for men and women behind the ladder and trapdoor. Electricity powered the lighting and a small stove for that all-important cup of tea.

Courtaulds factory in 1929 before the shelters were built. The shelters were on the far side of the factory. Photo from Britain From Above

The first bombs drop on Halstead

Barbara remembers some of the first bombs to drop on Halstead on 16 August 1940. A cottage in Box Mill was damaged, another fell behind the Hospital and along the fields between Parsonage Street and Blue Bridge.

Apparently there wasn't enough room for everyone, workers and nearby residents. Barbara reveals: 'The Courtauld staff had priority during the working day, but residents used them at night. During 1940 the warnings were so frequent that my parents and I often spent nights down in the shelters. Later in the war, I'd listen out for the V1 'Doodlebugs' which, when the sound of their engines cut out, meant that they were heading downwards. We'd make a dash for the shelters.'



1946 (from 1938 revision) 6" OS map

Muriel Constable started working at the weaving factory, aged just 14. During the War they made silk cloth for parachutes; a true 'war effort'. This is probably why the owners provided the shelters, should the factory become a target for enemy aircraft.

What section did you work on at Courtaulds?

'At first I was an office errand girl and then went on the twist belts, where workers got the threads ready for weaving. Posh people wore viscose, some had striped shirts of all colours. We had three beams and three lots of rods and you had to keep count.

Muriel Constable

'In the Redrawing Section were tiny looms, like my grandmother had used. The Cutting girls would hand me the cloth which I took over my arm to the Gauze Room, where it was checked.

I did weaving next. Didn't fancy that. It seemed so worrying and noisy. I had to learn it all in a month. Lilah Arnold, who was Lilah Seward, who has just celebrated 72 years of marriage, was one of my school friends and also worked with me in the factory.'

Parachute silk manufacture during WWII

'They couldn't get them out quick enough so they brought some of us out of weaving to do the twisting. We made material 100 yards long. It was important there were no cracks in the material as it could endanger the parachutists' lives.'

What happened when the alarms went off?

'The hooter sounding was the signal for us to dash to the shelters. In the Weaving, I'd got to stop four or six looms, pick up my gas mask, grab my food and knitting. We all

Entrance to one of the flooded shelters. Photo Jan Mellon

had to get under cover, and quick. You knew your shelter, sometimes the 'All Clear' would go almost straight away. I never was scared though.'

Courtauld patriarchal care

They were exemplary employers with a social conscience. They provided houses for the workers, the Cottage Hospital, the Homes of Rest as well as many sporting opportunities and garden parties.

A big event for Muriel was receiving her 30 years Long Service watch. A trip to London, staying in a hotel, a tour of the capital and then on to a show, *Half a Sixpence* starring Tommy Steele. At the presentation Muriel recognised a local Courtauld gentleman 'sitting on the stage with the big nobs like. When he heard my name as coming from Halstead, he really perked up. You see the other workers came from all over the country from their other factories.'

Muriel worked there for 44 years. She lost her job a bit early because 'they put me out when they was getting rid of a lot of the workers.'

Very sadly, Barbara Root died a few years ago. Muriel Constable died on 31st August 2020 aged 100. To the end she was a staunch supporter of both Halstead 21st Century Group and Halstead Trinity Church. She cared about the fate of the air-raid shelters that protected her but which now need protection themselves. We now know that the shelters were built in 1939. However, while many air-raid shelters were intact at the end of WWII, very few shelter groups of this size and type have survived the ravages of peacetime development. Ours have, and they're an important part of Halstead's local history, its industrial and Second World War heritage. That's why one of our key projects is to save them for future generations.

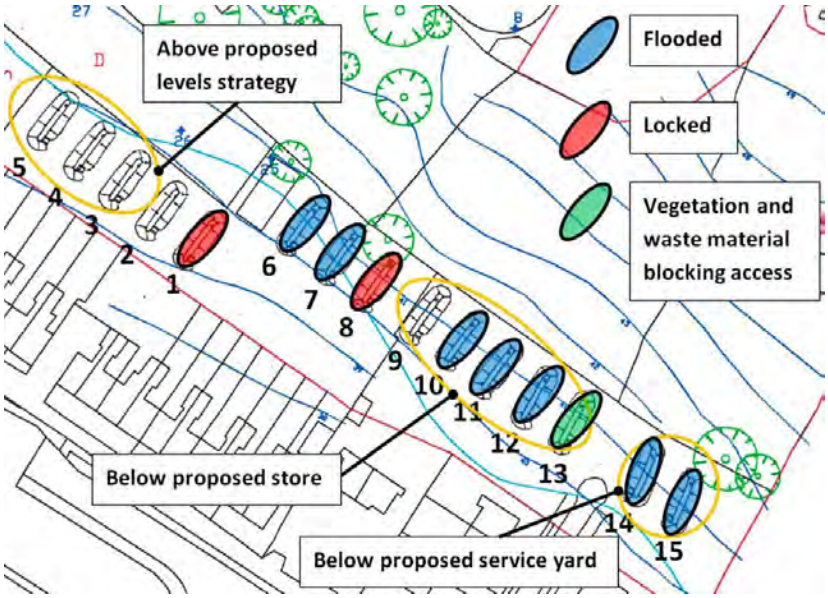
One of the new lids fitted to deter access. Photo Jan Mellon

Recent fly tipping and water damage

Sadly the shelters have suffered from even more antisocial behaviour, fly tipping and flooding since their profile has been raised in recent years. It seems the more the locals are made aware of their existence the more they attract the wrong sort of attention. Due to concerns raised by residents about the antisocial behaviour, Salvation Army Housing Association who own the land have put up warning signs and put locked covers on those escape hatches that are accessible (a few are too overgrown).

Following some water runoff from the site (and its water courses) into someone's garden, SAHA were contacted and work to divert the water course led to more of the shelters being flooded.

The group have heard nothing more about what's happening to the land but signs warning visitors to the site of risks appeared quite recently. The group are still working on how to progress their vision.



Unusual Royal Observer Corps Post uncovered, Wokingham, Berks

Edwina J Holden

Wessex Archaeology have uncovered the roof of the buried ROC post. Photo from Wessex Archaeology

Wessex Archaeology discovered an unusual underground ROC Monitoring Post during preliminary surveys in advance of work on the Arborfield Cross Relief Road near Wokingham in Berkshire.

Back to front

This was known as Arborfield Post and was unusual due to the fact that it had been constructed back to front – a mirror image of the usual layout. Plans were supplied to local builders to construct ROC Posts; however, on this occasion they were obviously misinterpreted.

A small number of posts were constructed with this reverse layout but no one is quite sure why. If the blueprints were simply printed back to front then surely all the measurements and other text would also be reversed, making the error obvious.

There is some evidence that groups of local posts were reversed, suggesting a small number of contractors were responsible. There is no evidence that this reversal caused any problem with efficiency during training exercises over the years.

After removal of the roof the monitoring room is revealed

The Arborfield post after excavation of the site. Photo Jack Watkins

Arborfield Post reported into No 14 Group HQ, Winchester. It was part of the national network of 1,563 posts that were built between 1957 and 1965 as part of preparations for the reporting of radioactive fallout should a nuclear strike occur. Arborfield Post was in use from 1961 until 1968.

In the event of a nuclear strike there would have been three Observers on duty: a Chief Observer, Leading Observer and an Observer, all volunteers. These would have been overseen by a spare-time Group Officer who was responsible for a cluster of posts.

During World War II an above-ground Reporting Post was on the same site. Radar covered only the coast – once inside the UK the ROC took up the reporting of hostile aircraft to warn the RAF of their path for which the posts earned the title *The Eyes and Ears of the RAF*. Post members were also able to help crews of friendly aircraft in distress to find a suitable landing site.

ROC members assist in the invasion of Normandy

Recent research has discovered that a member of Arborfield Post volunteered for the Seaborne mission in 1944 when up to 800 ROC members served on merchant ships to prevent friendly fire on Allied aircraft by the ship's gunners. Two Observers were killed during Operation Overlord – the Normandy landings.

Arborfield post site after removal. Photo Jack Watkins

Arborfield post crew in 1939. Left is W.C. Grant. The observer wearing the headphones is Richard J. Middleton - with whom I am familiar. On the right Major (Retired) Henry Morris who was Head Observer. Photo from Sheila Bunce

Royal Observer Corps Heritage are grateful to contractors Balfour Beatty for their plans to install a Memorial Stone close to the site showing the ROC badge and name of the Post. The ROC Heritage Team and Arborfield History Group have been very involved with this project and we are grateful to Diana Thorne for keeping us up to date as things have progressed.

The exciting project carried out by Balfour Beatty following their discovery of the Underground Monitoring Post at Arborfield near Wokingham during excavations has been well documented. The project has now come to fruition with the erection of an impressive Memorial Boulder to remember the members of the Corps who had served in World War II on the above-ground Post, not forgetting the Seaborne member, and the underground Cold War Post. The photograph shows the plaque, sponsored by Balfour Beatty, mounted on the Boulder which is of Derbyshire Gritstone generously donated by The Coombes Nursery and Infant School in Arborfield.

Not only do we have the plaque to remember our history but a footpath next to the new relief road will be known as 'Observer Way'. The new bridge over the road will be titled 'Observer Bridge'.

Memorial stone being manoeuvred into place before it was engraved; it was later removed and taken to a stonemason

It will be remembered that all this came about because a new road system was to be constructed and members of Wessex Archaeology uncovered the roof of an underground Monitoring Post located at the extreme end of a trench while working for Balfour Beatty as part of Wokingham Borough Council's £124M Major Highways Project. The Post's location had been known but it was thought that the structure had been removed.

Diana Thorne of the Arborfield Local History Society became involved when the underground Post, erected in January 1961, was discovered and she found the ROCA Heritage website. Diana has worked tirelessly with others to bring about this amazing result. The Wartime Observer Corps Post was opened in 1936; following the success of the Corps in the Battle of Britain King George VI bestowed the title 'Royal', the only such organisation to receive such an accolade during wartime.

It is particularly pleasing that descendents of the Observers are living in the village and can pass on their memories, particularly of testing relatives in aircraft recognition with the flash cards which were used at the time.

The stone in place

ROCA Heritage is most indebted to Balfour Beatty for financing the project, Diana Thorne for overseeing and achieving the final result, also: Arborfield Local History Society, Arborfield Parish Council, Wessex Archaeology, and Wokingham Borough Council.

Appreciation

Edwina J Holden MBE is National Heritage Officer of the Royal Observer Corps Association. Sub Brit is grateful to her for this report.

German Underground Hospital Postcards

Sub Brit member Michael Thomson recently found three postcards of the German Underground Hospital in Jersey for sale and kindly sent them in for publication. They are postally unused but from their appearance date from the very start of the opening of the site to the public in 1946.

The never-completed site is also known as Hohlgangsanlage 8 and it was intended to be a casualty clearing station but never completed. One of the cards shows a partially excavated connecting corridor whilst the others show the entrance and a completed corridor.

Now known as the Jersey War Tunnels, and situated in the Parish of St Laurence, the site is still a popular site. With over 150,000 visitors a year the tunnels are probably the island's most popular paid tourist attraction.

The Bock Casemates, Luxembourg City, Grand Duchy of Luxembourg

Paul W. Sowan

I visited Luxembourg City, a short trip from Thionville by train, one afternoon during a week otherwise devoted to exploring Maginot Line forts with Dan McKenzie *et al*. My main purpose was to visit the Bock Casemates, but I also toured the impressive city museum.

The entire Grand Duchy of Luxembourg is about the size of Derbyshire, with a population of 483,800, of whom 85,500 live in the capital. This lies on mostly Jurassic sedimentary rocks forming the lower-lying southeastern part of the country. Older rocks form the higher land of the Ardennes to the north and west.

It is a curious city, lying at the confluence of the rivers Alzette and Pétrusse. Both rivers, and the confluence, flow through deep steep-sided gorges which effectively divide the city into parts which are linked by numerous rail and road bridges. At one point, on the eastern side of the city, the Alzette takes a sharp turn, flowing at one point eastwards, and then a hundred metres or so downstream westwards again. The spur of high ground between these two stretches of the river is known as the Bock, and is riddled at several levels with rock-cut tunnels and cannon-positions, all open to the public. It is a curious place to visit, as one moment you may be ascending or descending steep and narrow dimly lit staircases inside the rock; the next, you are enjoying splendid views to north and south from the open, airy casemate galleries. It might I suppose be called a 'poor man's Gibraltar'; and has indeed been referred to as the 'Gibraltar of the North'.

The system originated as a surface fort erected on the Bock by one Count Siegfried in 963 AD. This had massive defensive walls on the west side, the remaining sides being effectively defended by their precipitous cliffs. In the course of time, a tunnelled system was created running to 23 kilometres of rock-cut stairways and galleries. This could house thousands of troops, and their horses, equipment, and workshops and the like.

In line with Luxembourg's adoption of neutrality, the above-ground fortifications were demolished in 1875. But short of destroying the entire spur of rock, the casemates could not be destroyed. Although various entrances and passages were at that time blocked, it is still possible to access 17 kilometres of the system. The tunnels were valued as airraid shelters during both World Wars, and since then have become one of the prime tourist attractions of the city. In 1994 the Bock was declared a UNESCO World Heritage Site. Much of the lower land on the floors of the river gorges is quiet and unspoiled parkland with riverside walks and some of the older and more attractive buildings. Rather like the situation at New Mills in Derbyshire, you could easily visit the modern

city centre without realising there were gorges and rivers at all! Only occasionally can you peer over a bridge parapet, or find a viewpoint from which the quieter area can be seen. There are in fact two sets of underground casemates in the city, both open to the public, although those in the cliffs overlooking the Pétrusse were closed on the afternoon I visited.

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Reference

NAVAL INTELLIGENCE DIVISION, 1944, *Luxembourg*. [UK] Naval Intelligence Division Geographical Handbook: ix + 355pp + 46 plates..

[It may seem curious to find the Royal Navy commissioning a substantial volume on a land-locked state, conspicuously lacking in docks and harbours!]